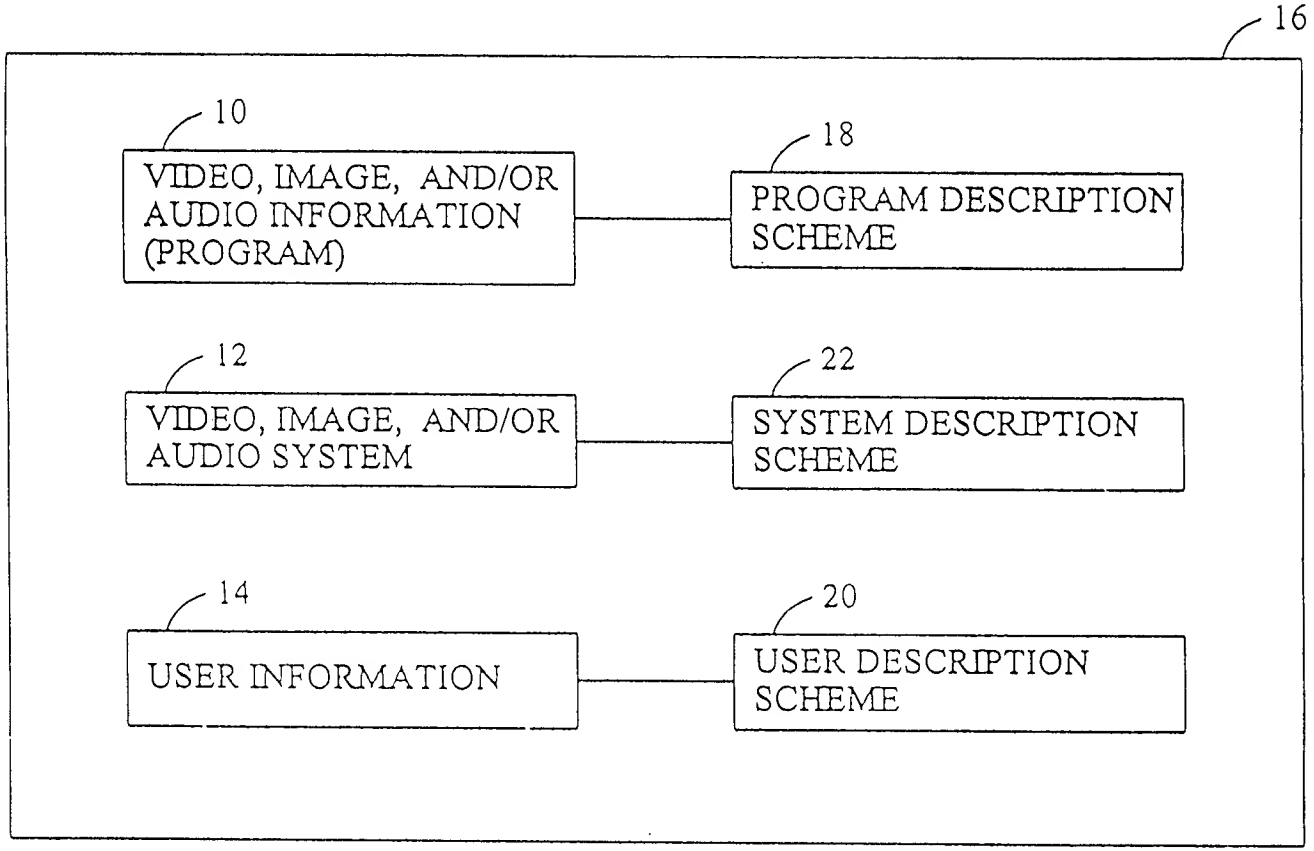

16
10
VIDEO, IMAGE, AND/OR AUDIO INFORMATION (PROGRAM)
18
PROGRAM DESCRIPTION SCHEME
12
VIDEO, IMAGE, AND/OR AUDIO SYSTEM
22
SYSTEM DESCRIPTION SCHEME
14
USER INFORMATION
20
USER DESCRIPTION SCHEME

FIG. 1

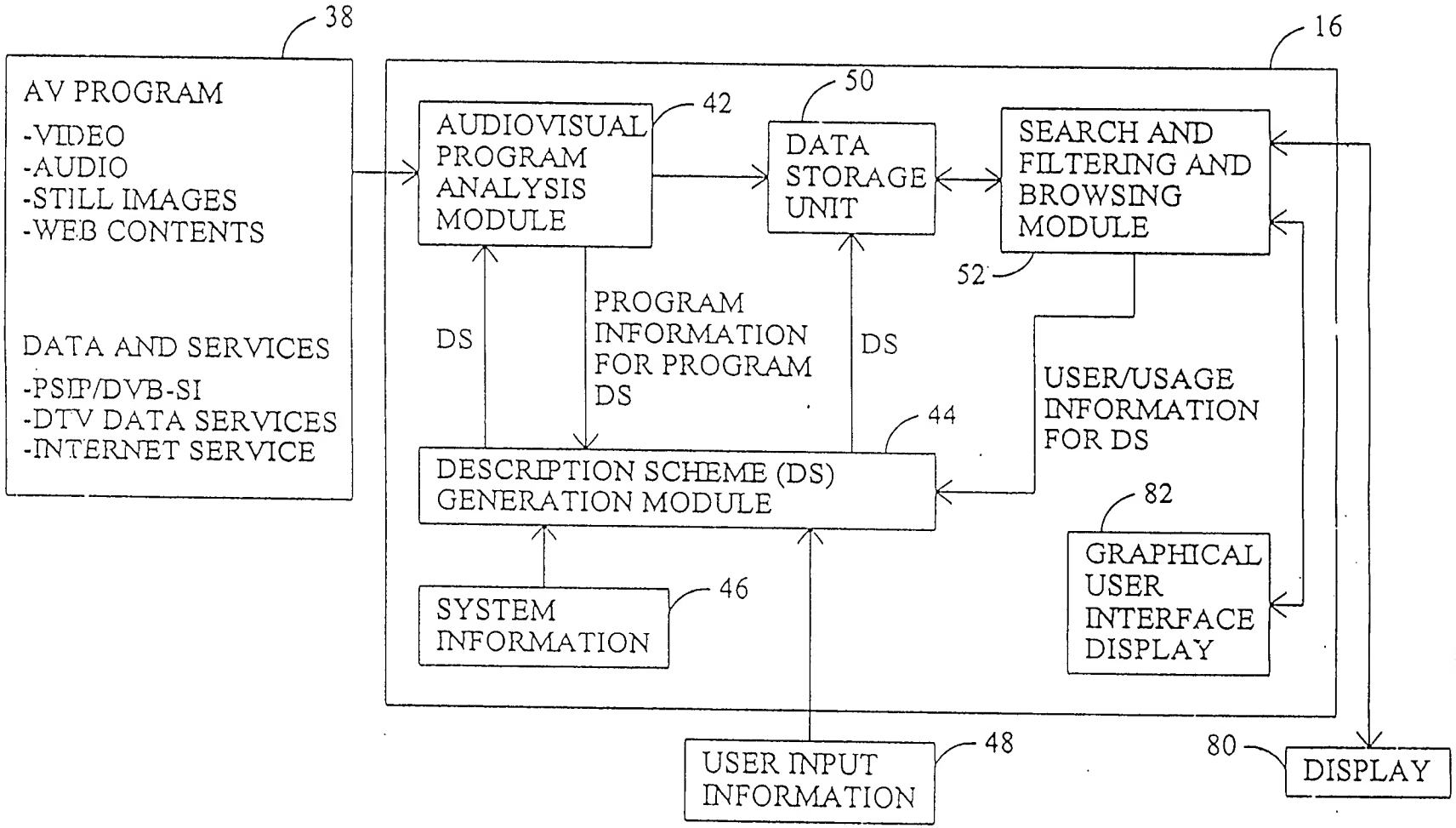

38
AV PROGRAM
-VIDEO
-AUDIO
-STILL IMAGES
-WEB CONTENTS
DATA AND SERVICES
-PSIP/DVB-SI
-DTV DATA SERVICES
-INTERNET SERVICE
16
AUDIOVISUAL PROGRAM ANALYSIS MODULE
42
DATA STORAGE UNIT
50
SEARCH AND FILTERING AND BROWSING MODULE
52
DS
PROGRAM INFORMATION FOR PROGRAM DS
DS
USER/USAGE INFORMATION FOR DS
DESCRIPTION SCHEME (DS) GENERATION MODULE
44
SYSTEM INFORMATION
46
GRAPHICAL USER INTERFACE DISPLAY
82
USER INPUT INFORMATION
48
80
DISPLAY

FIG. 2

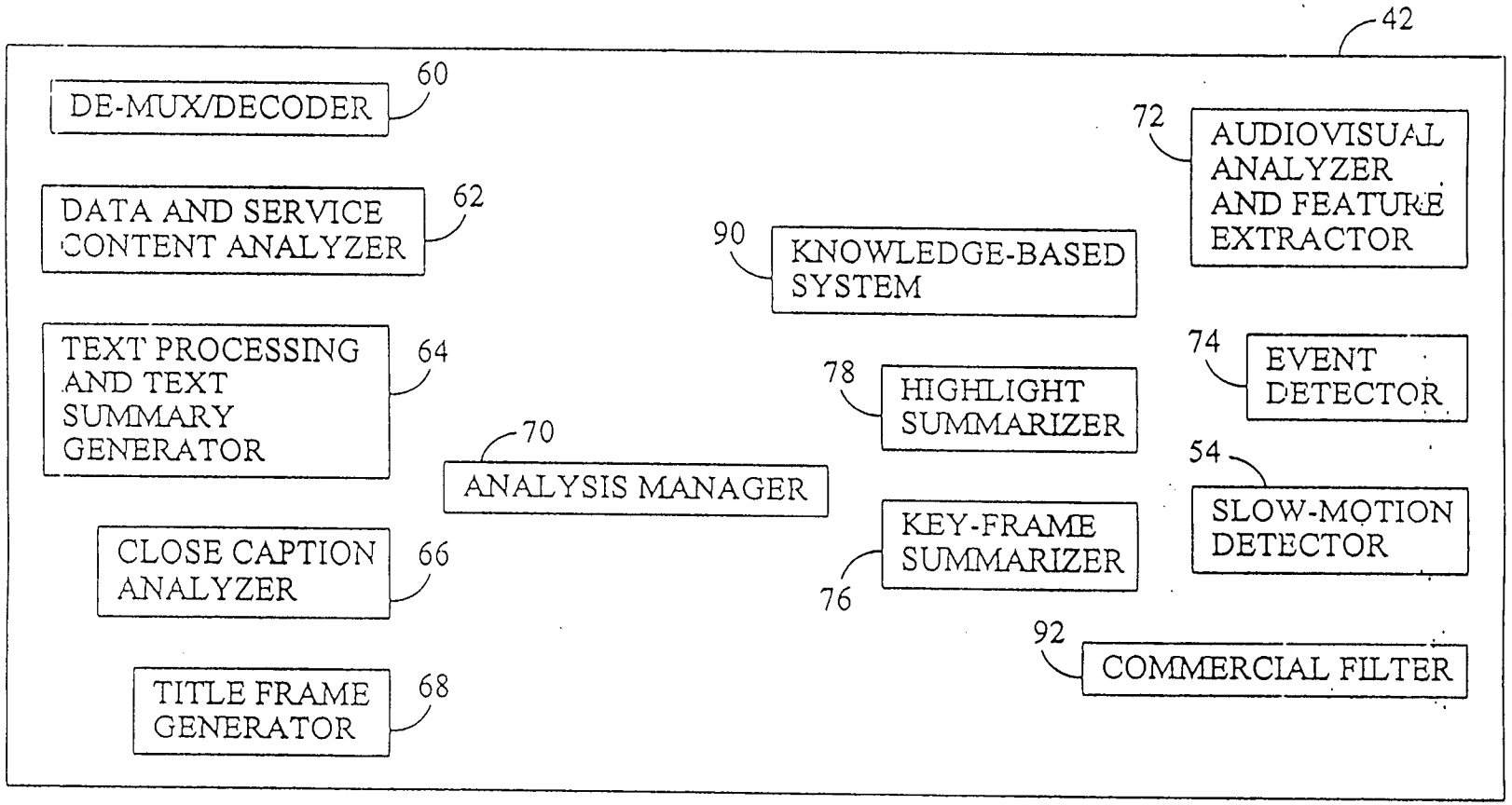

42
DE-MUX/DECODER
60
DATA AND SERVICE CONTENT ANALYZER
62
TEXT PROCESSING AND TEXT SUMMARY GENERATOR
64
CLOSE CAPTION ANALYZER
66
TITLE FRAME GENERATOR
68
ANALYSIS MANAGER
70
KNOWLEDGE-BASED SYSTEM
90
HIGHLIGHT SUMMARIZER
78
KEY-FRAME SUMMARIZER
76
AUDIOVISUAL ANALYZER AND FEATURE EXTRACTOR
72
EVENT DETECTOR
74
SLOW-MOTION DETECTOR
54
COMMERCIAL FILTER
92

FIG. 3

Thumbnail View (Category)

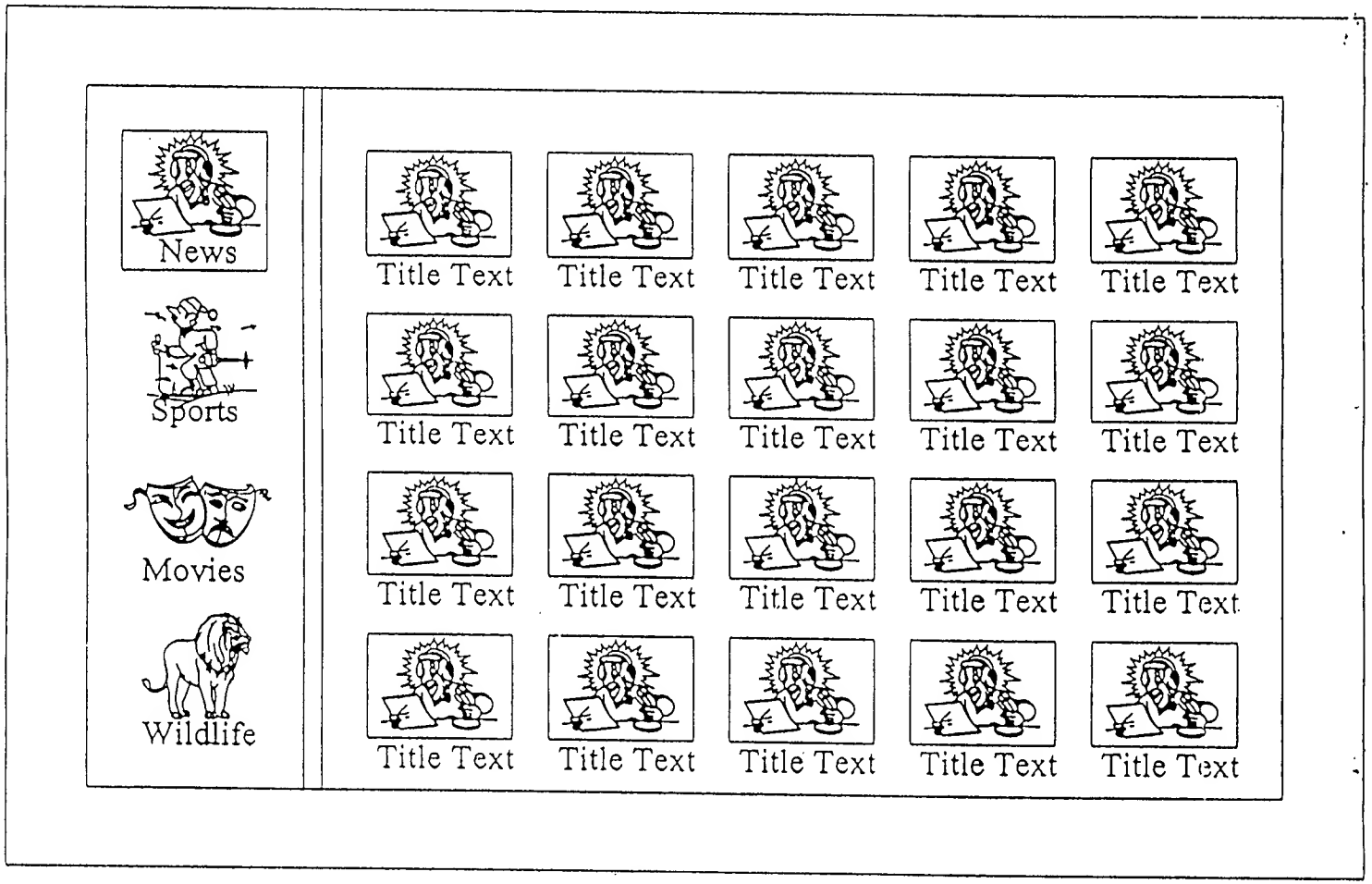


FIG. 4

Thumbnail View (Channel)

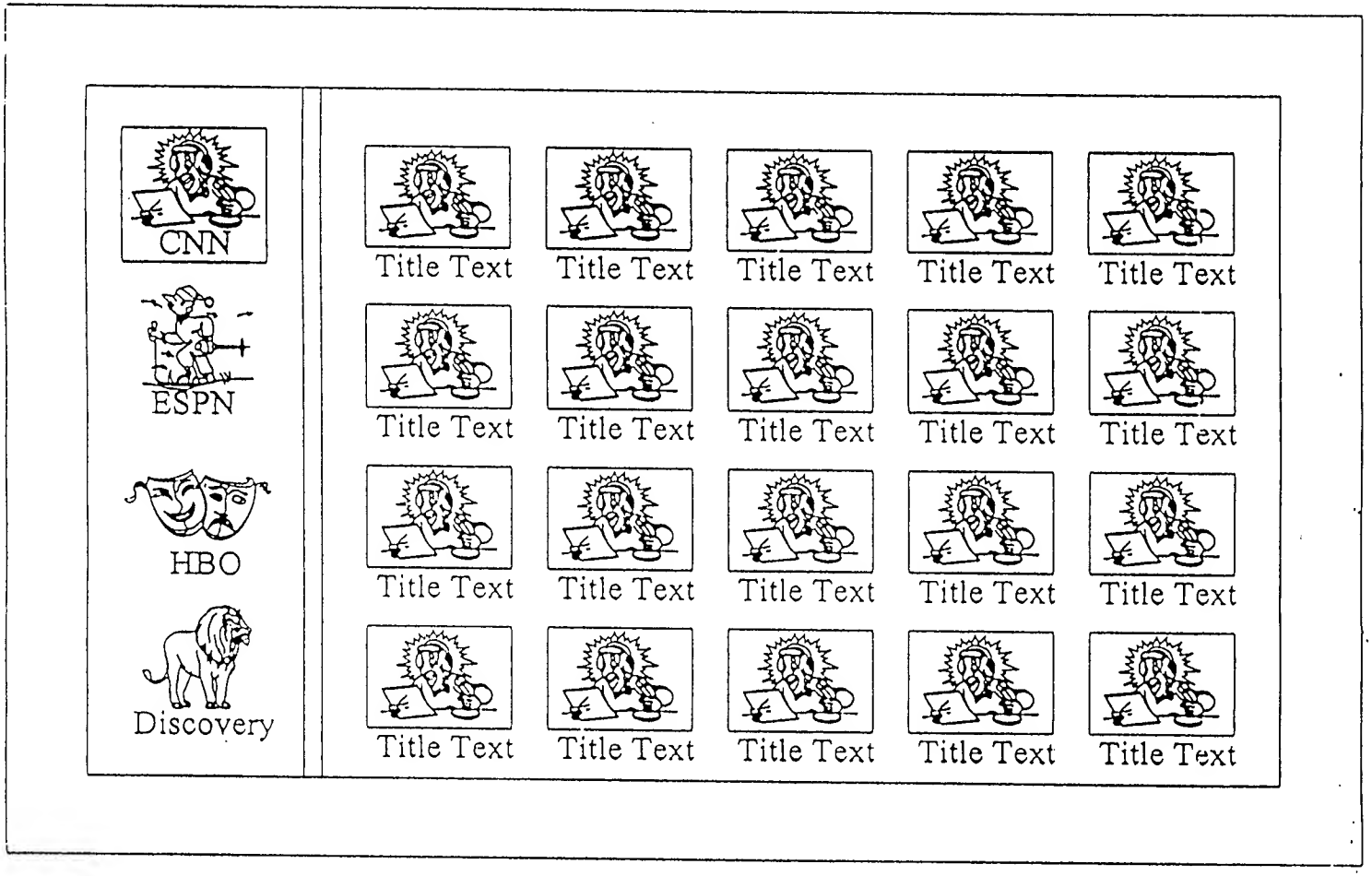


FIG. 5

Text View (Channel)

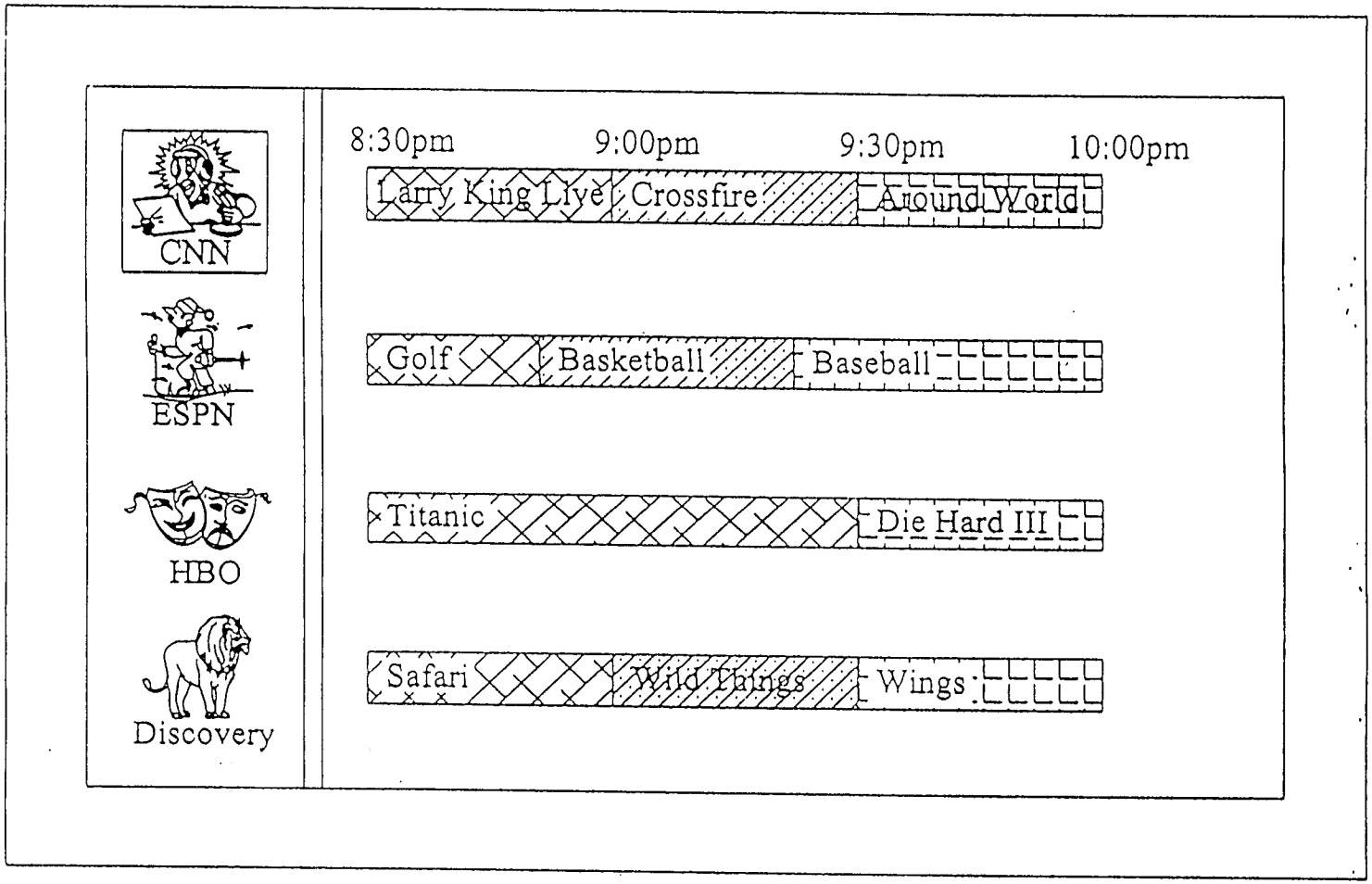


FIG. 6

Frame View

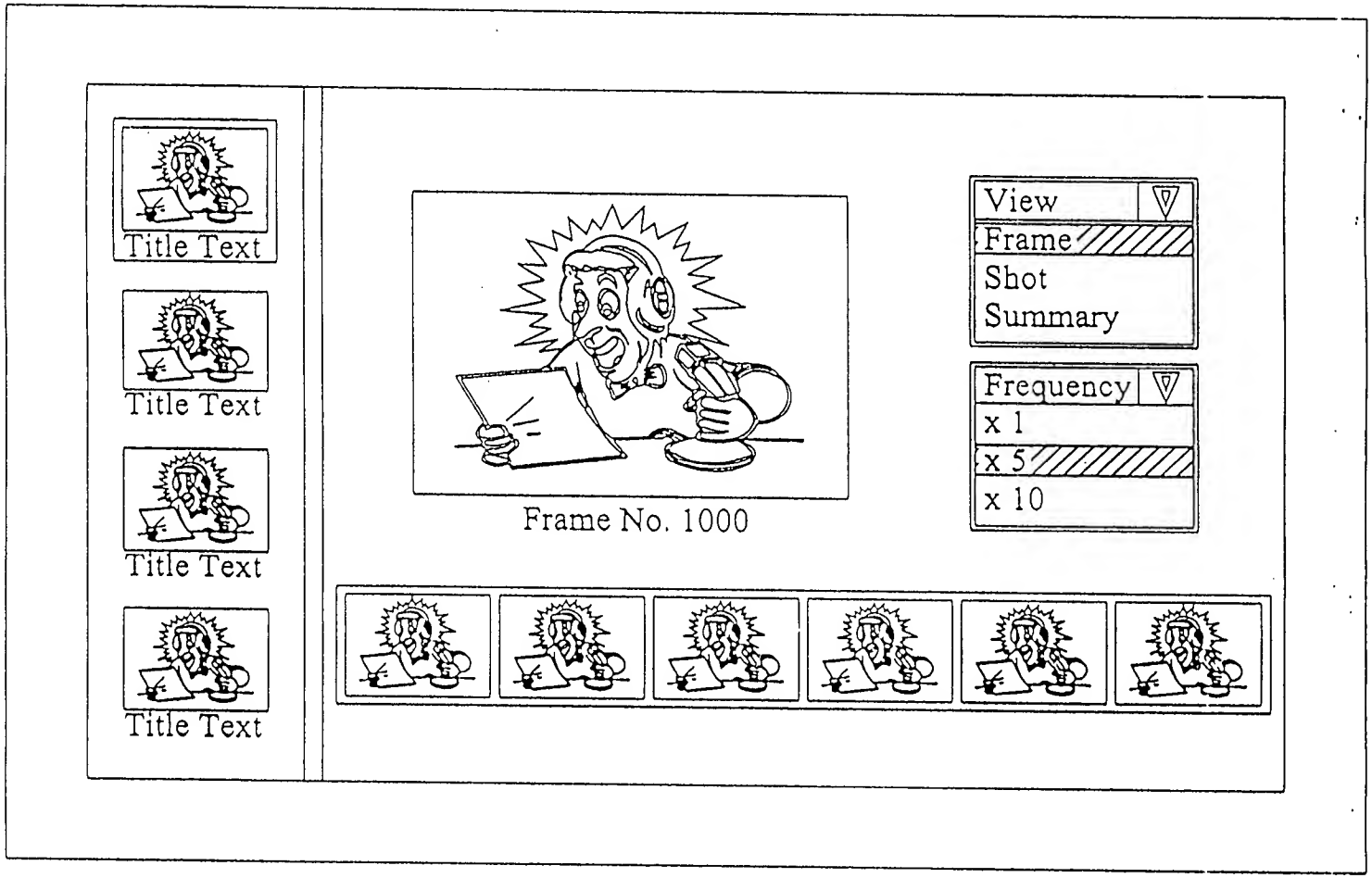


FIG. 7

Shot View

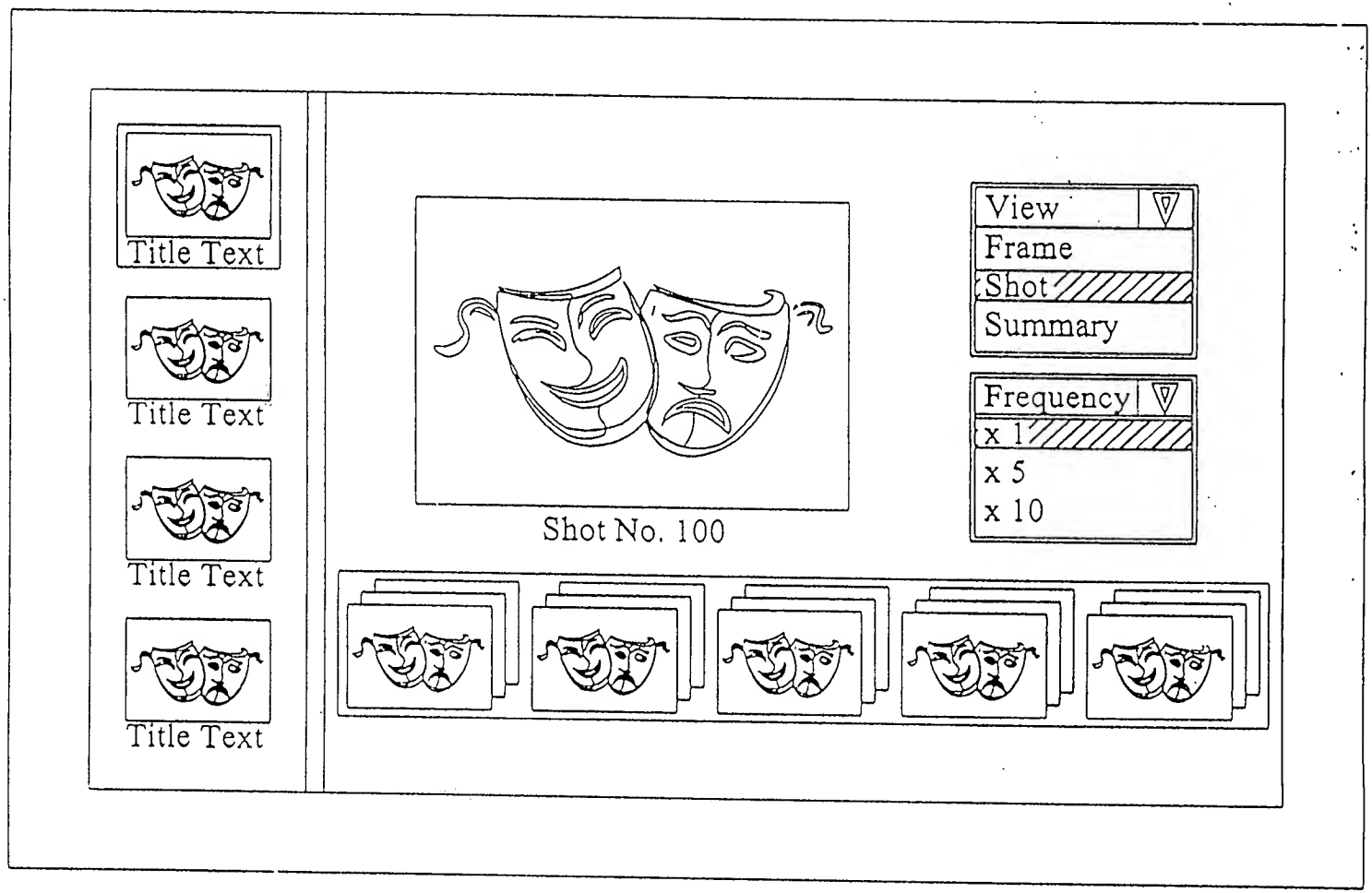


FIG. 8

Key Frame View

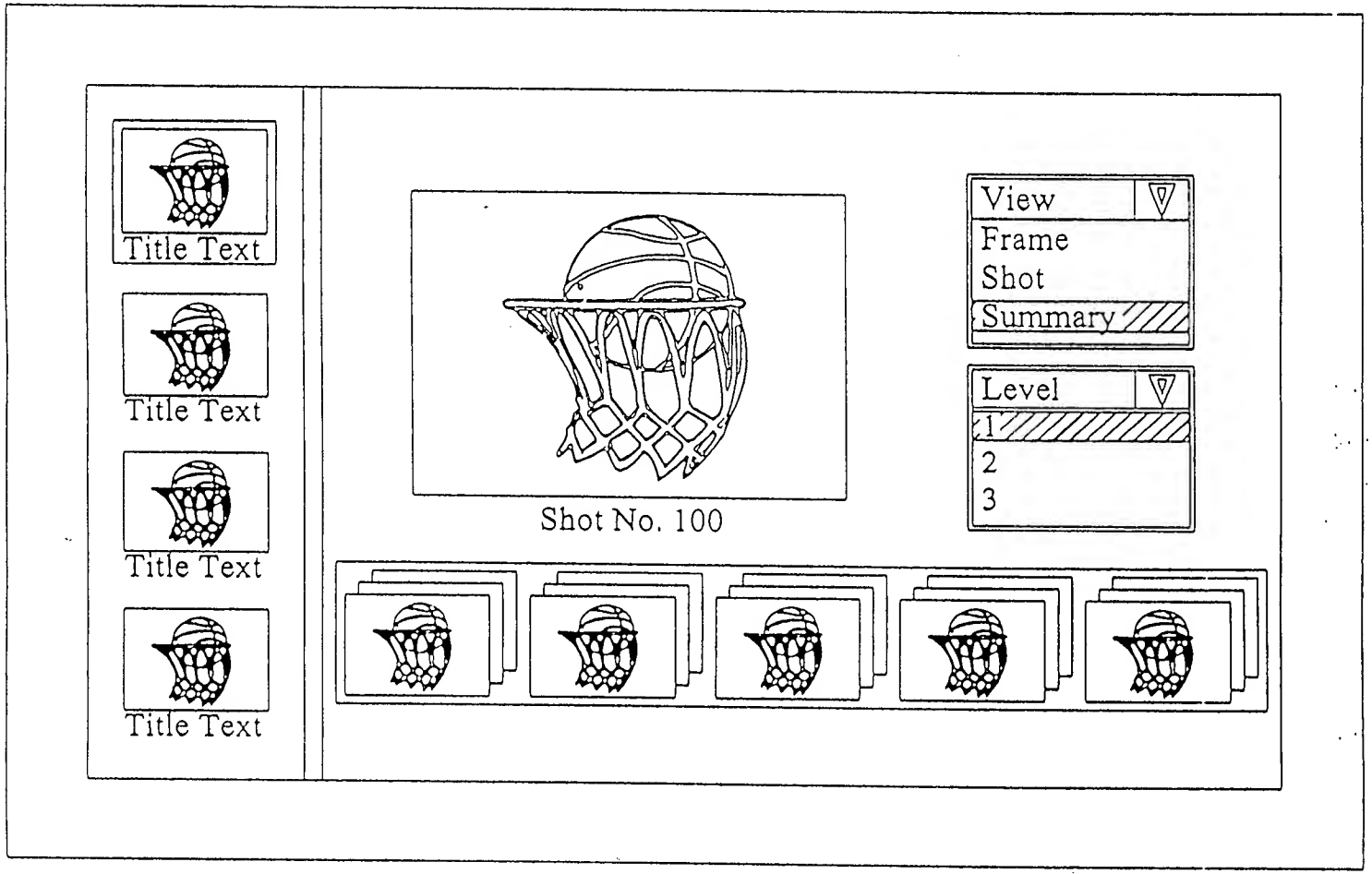


FIG. 9

Highlight View

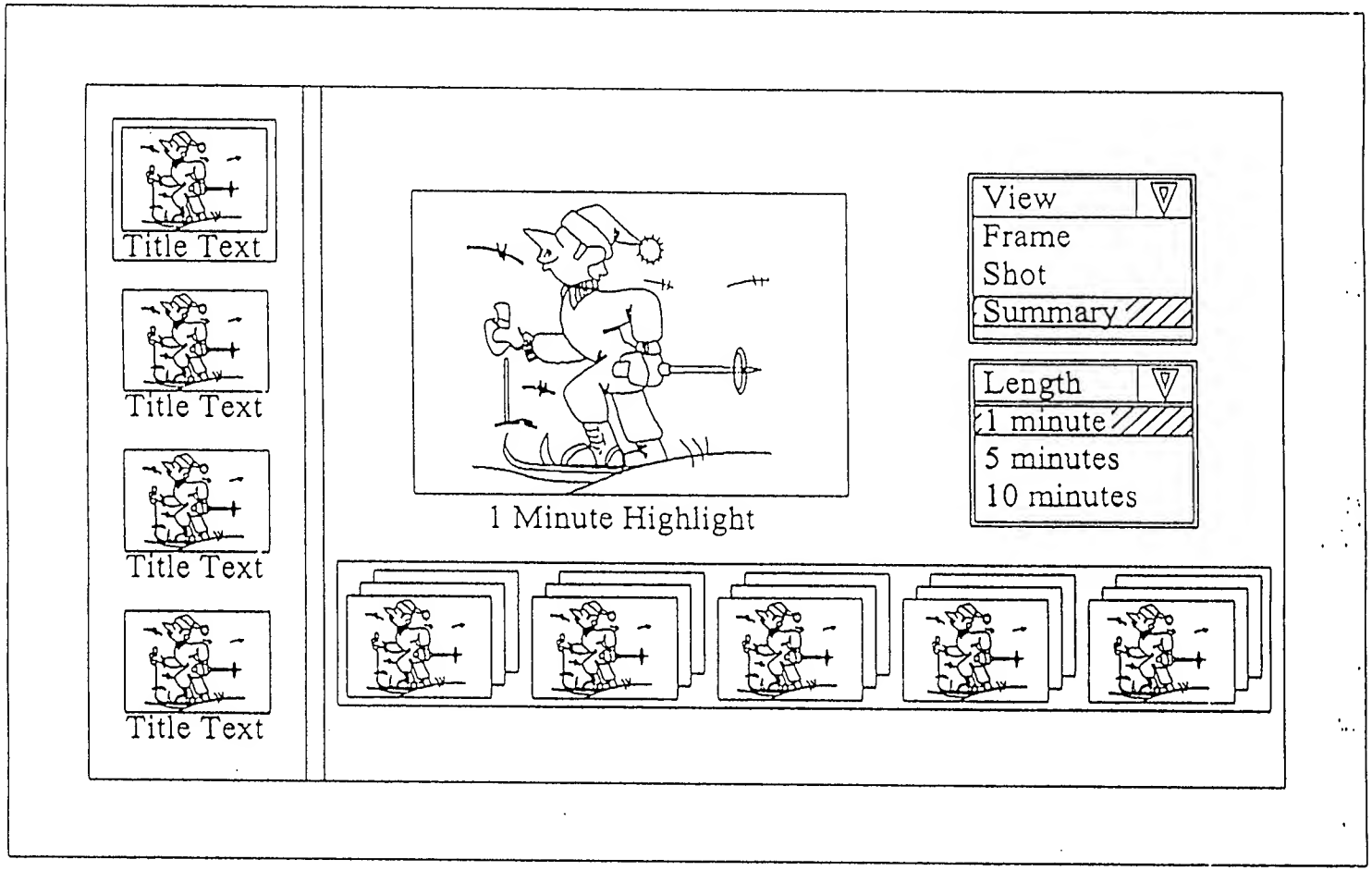


FIG. 10

Event View

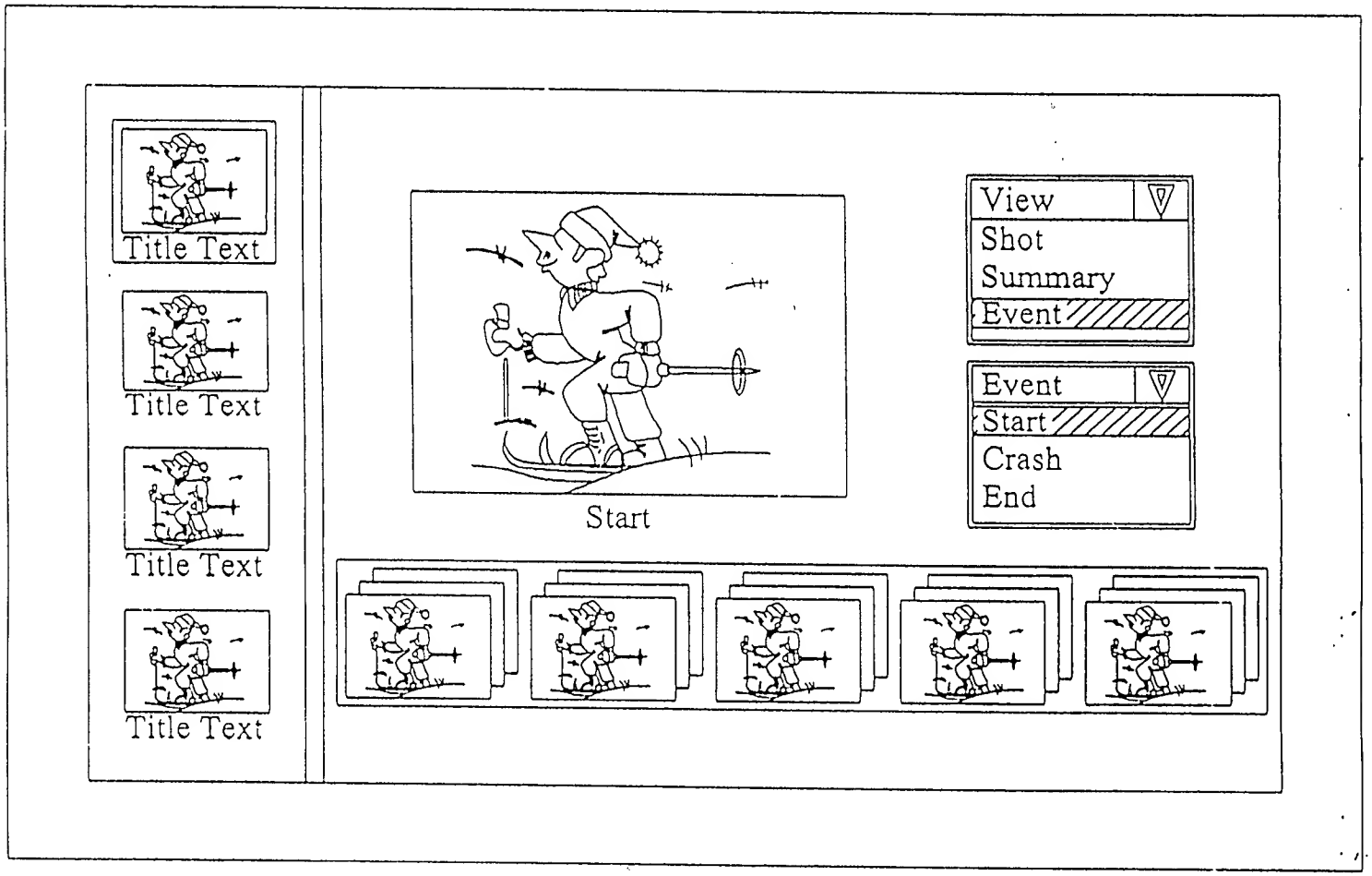


FIG. 11

Character/Object View

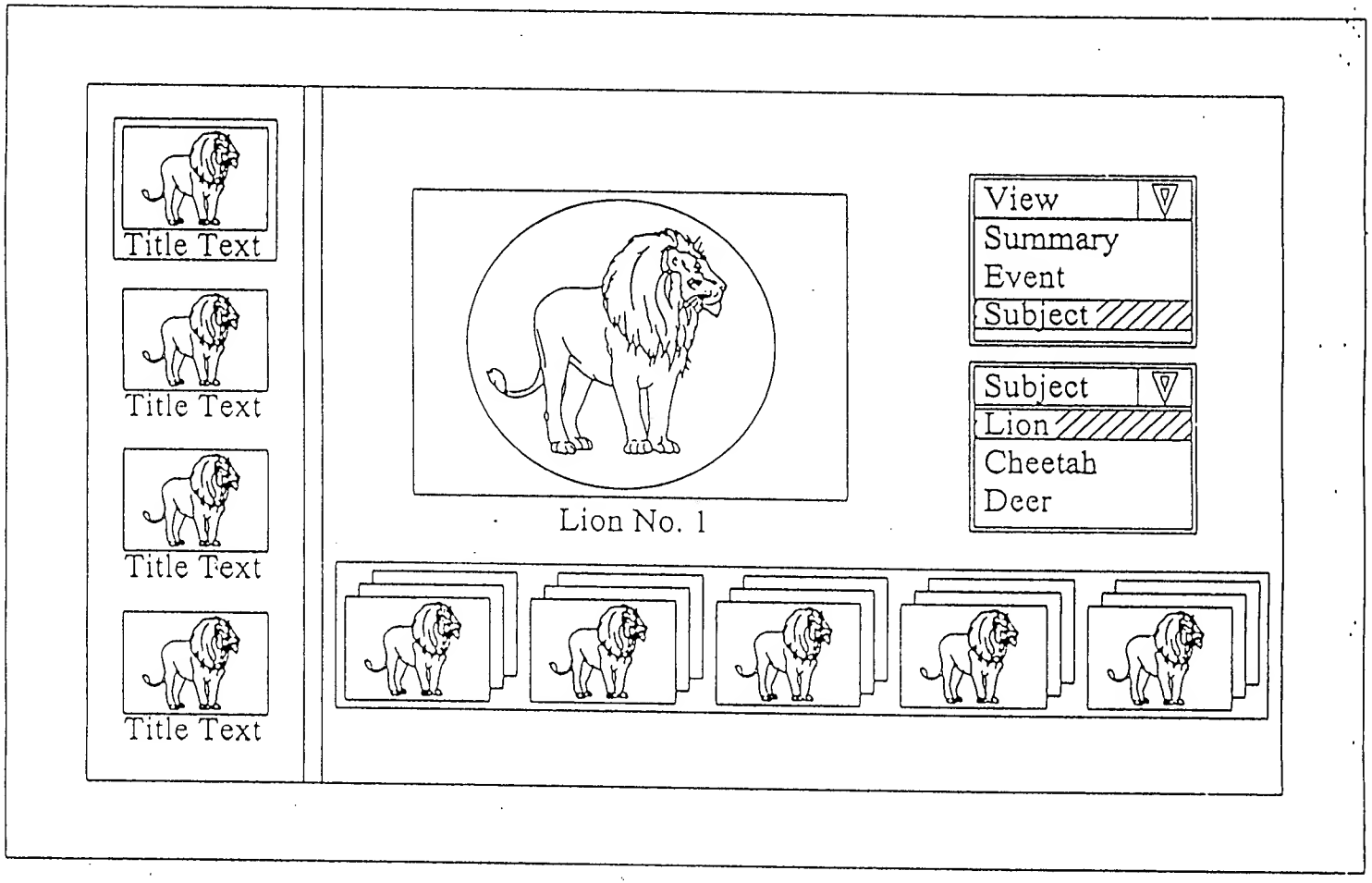


FIG. 12

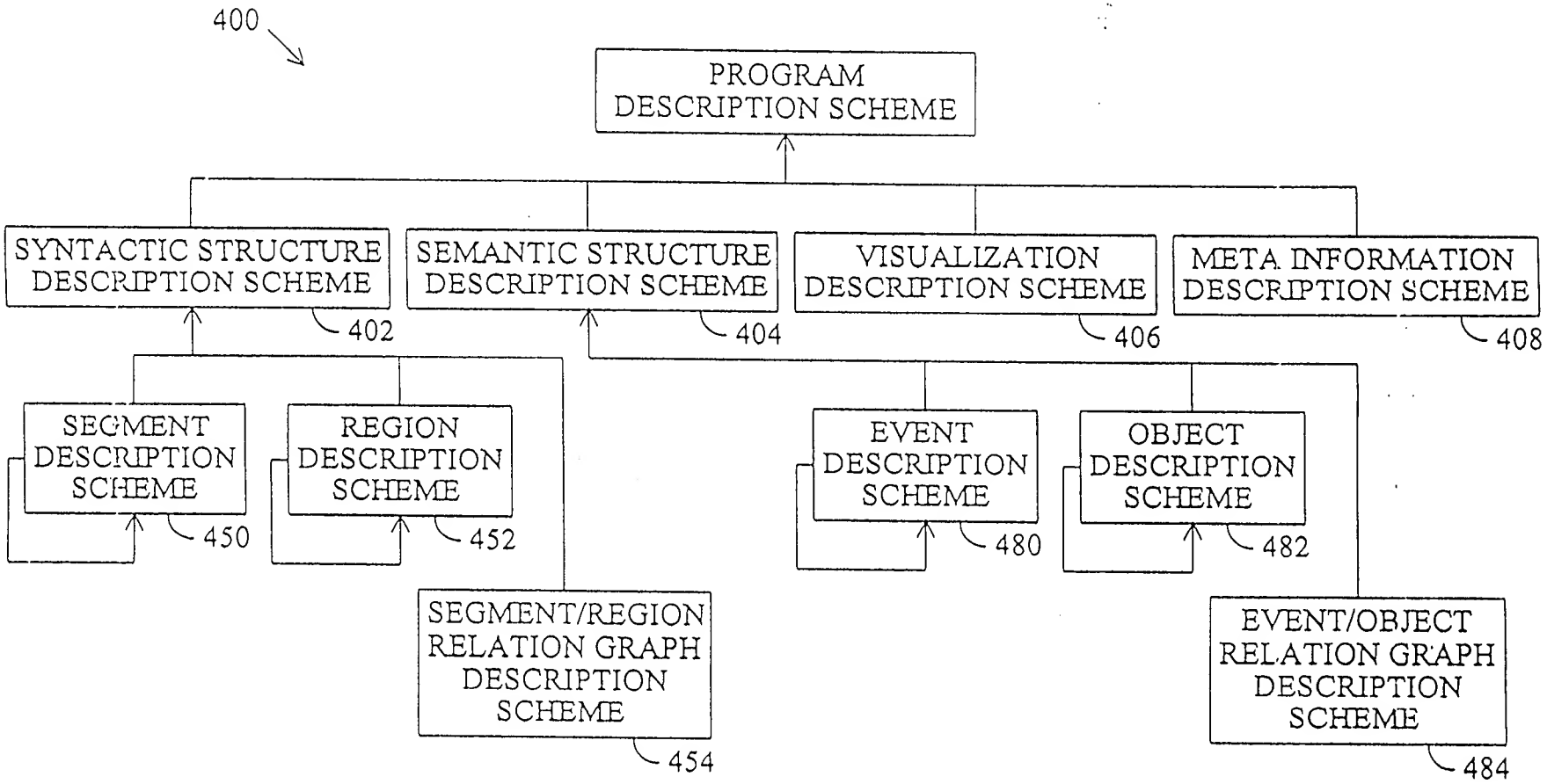

400
PROGRAM DESCRIPTION SCHEME
SYNTACTIC STRUCTURE DESCRIPTION SCHEME
402
SEMANTIC STRUCTURE DESCRIPTION SCHEME
404
VISUALIZATION DESCRIPTION SCHEME
406
META INFORMATION DESCRIPTION SCHEME
408
SEGMENT DESCRIPTION SCHEME
450
REGION DESCRIPTION SCHEME
452
SEGMENT/REGION RELATION GRAPH DESCRIPTION SCHEME
454
EVENT DESCRIPTION SCHEME
480
OBJECT DESCRIPTION SCHEME
482
EVENT/OBJECT RELATION GRAPH DESCRIPTION SCHEME
484

FIG. 13

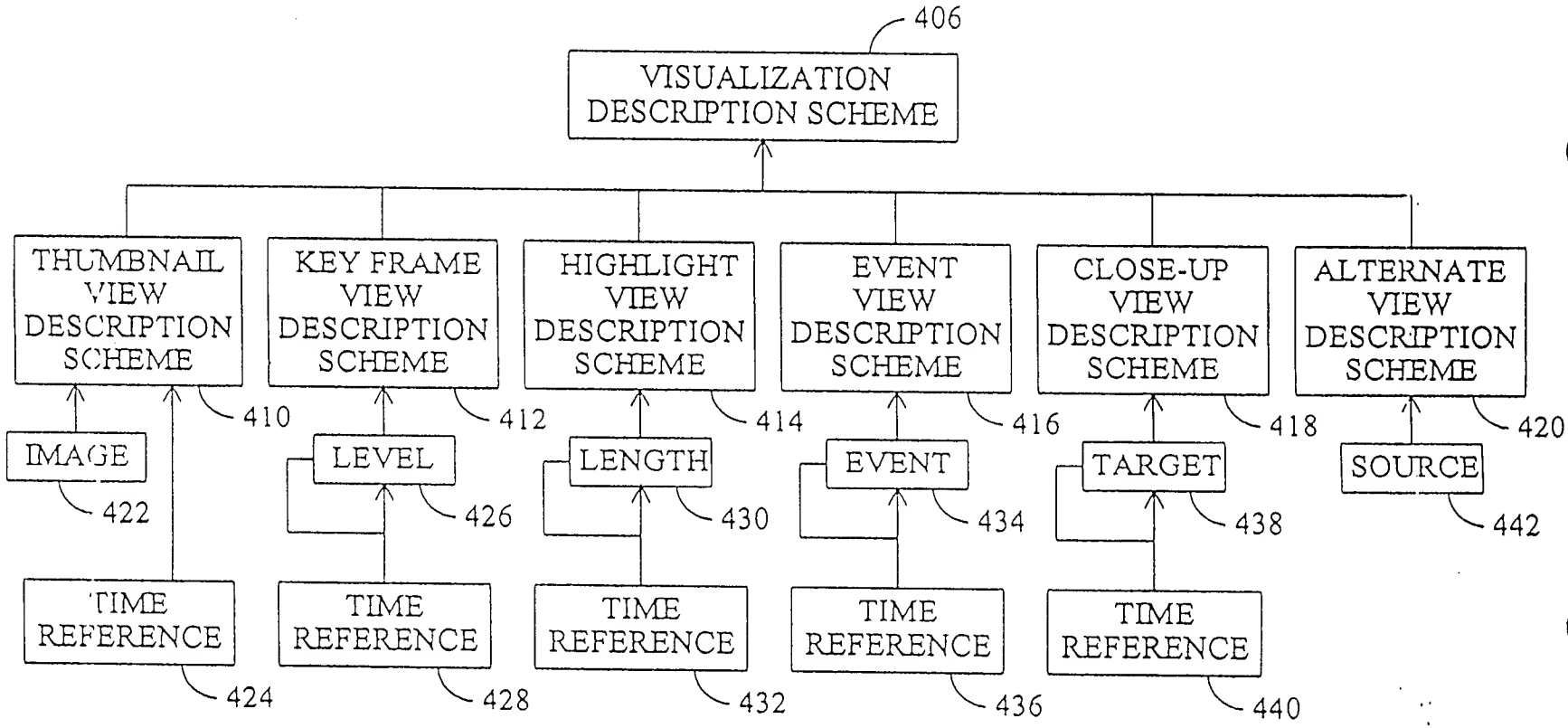

406
VISUALIZATION DESCRIPTION SCHEME
THUMBNAIL VIEW DESCRIPTION SCHEME
KEY FRAME VIEW DESCRIPTION SCHEME
HIGHLIGHT VIEW DESCRIPTION SCHEME
EVENT VIEW DESCRIPTION SCHEME
CLOSE-UP VIEW DESCRIPTION SCHEME
ALTERNATE VIEW DESCRIPTION SCHEME
410
412
414
416
418
420
IMAGE
LEVEL
LENGTH
EVENT
TARGET
SOURCE
422
426
430
434
438
442
TIME REFERENCE
TIME REFERENCE
TIME REFERENCE
TIME REFERENCE
TIME REFERENCE
424
428
432
436
440

FIG. 14

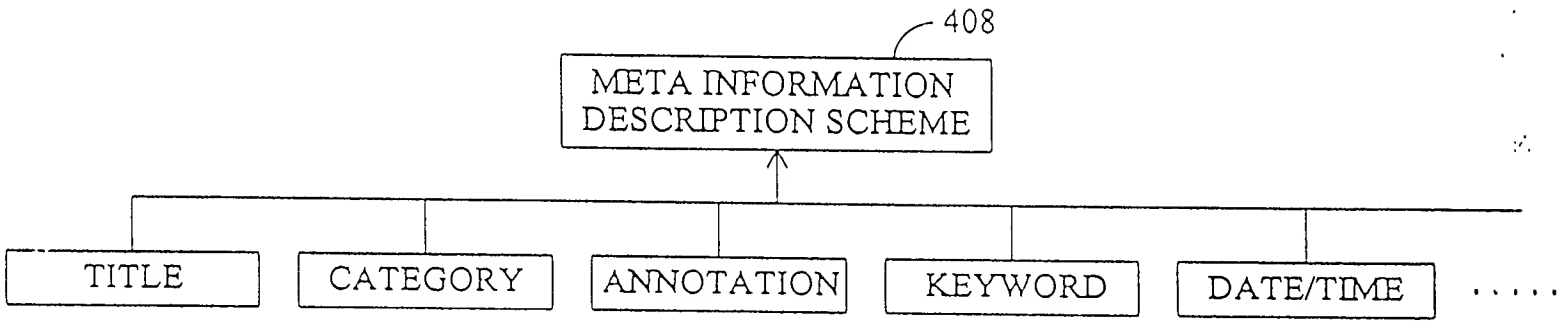

408
META INFORMATION DESCRIPTION SCHEME
TITLE
CATEGORY
ANNOTATION
KEYWORD
DATE/TIME
.....

FIG. 15

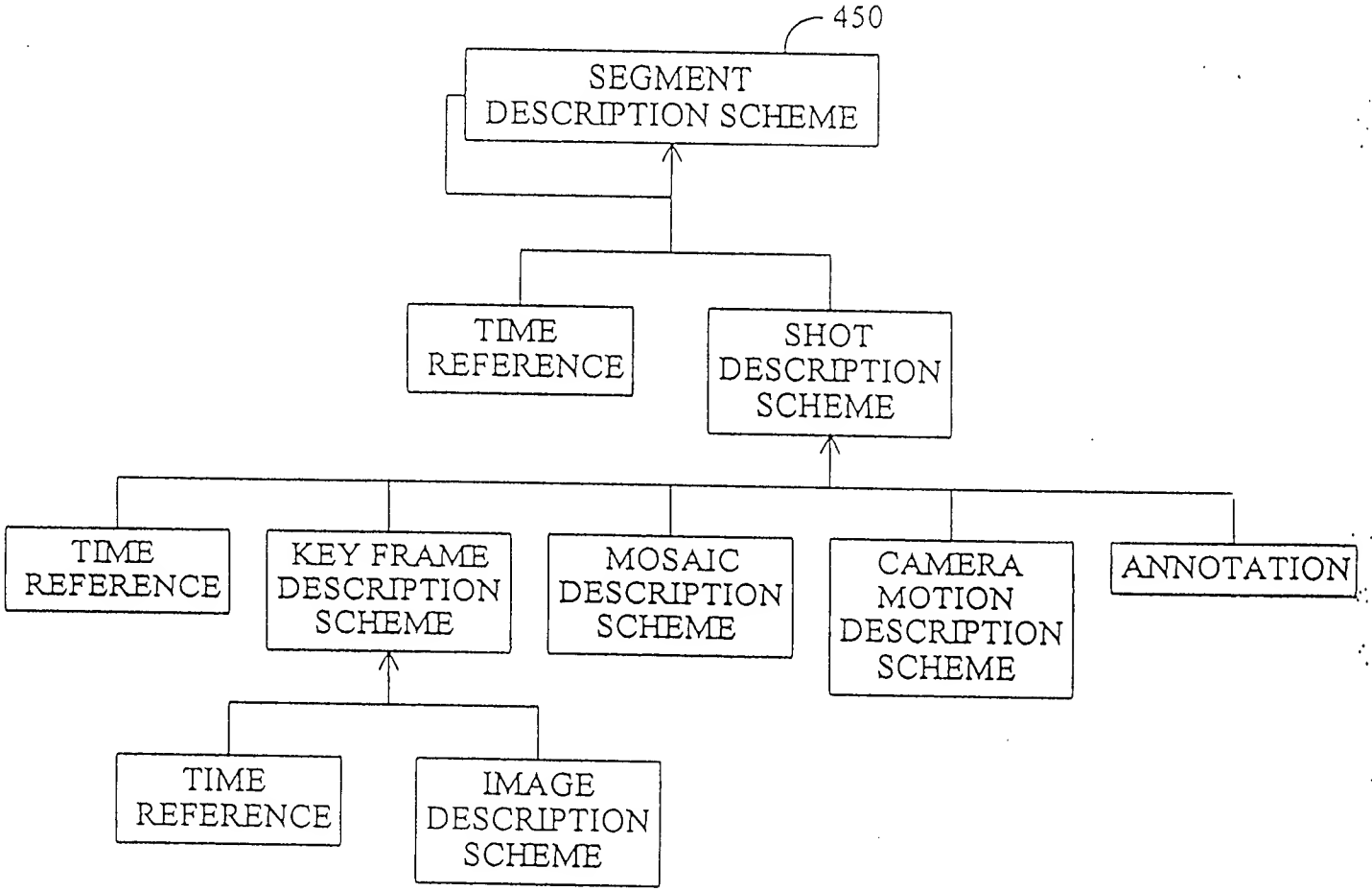

450
SEGMENT DESCRIPTION SCHEME
TIME REFERENCE
SHOT DESCRIPTION SCHEME
TIME REFERENCE
KEY FRAME DESCRIPTION SCHEME
MOSAIC DESCRIPTION SCHEME
CAMERA MOTION DESCRIPTION SCHEME
ANNOTATION
TIME REFERENCE
IMAGE DESCRIPTION SCHEME

FIG. 16

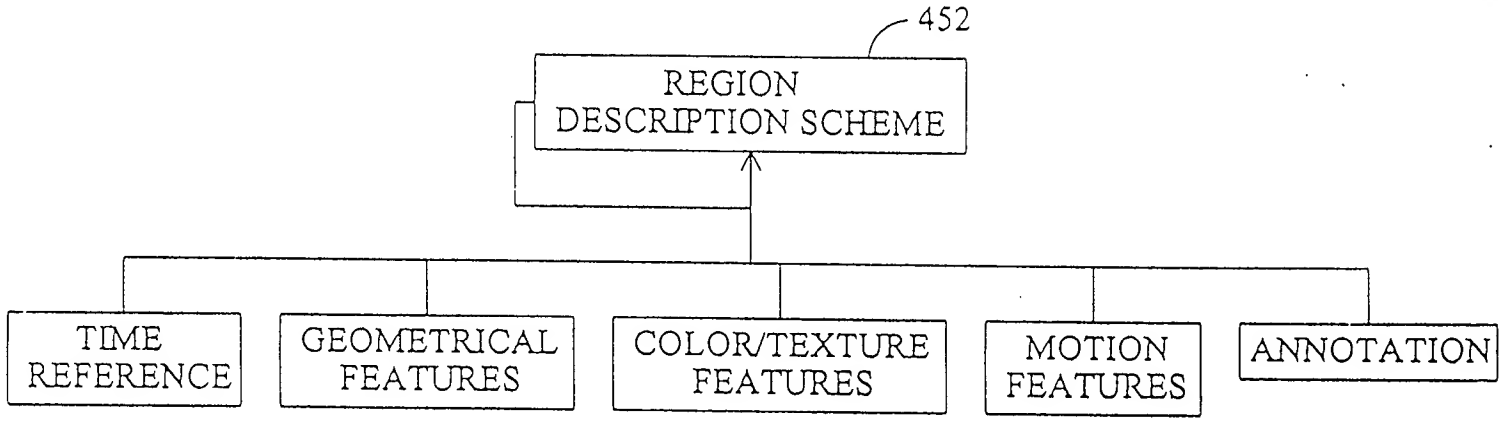

452
REGION DESCRIPTION SCHEME
TIME REFERENCE
GEOMETRICAL FEATURES
COLOR/TEXTURE FEATURES
MOTION FEATURES
ANNOTATION

FIG. 17

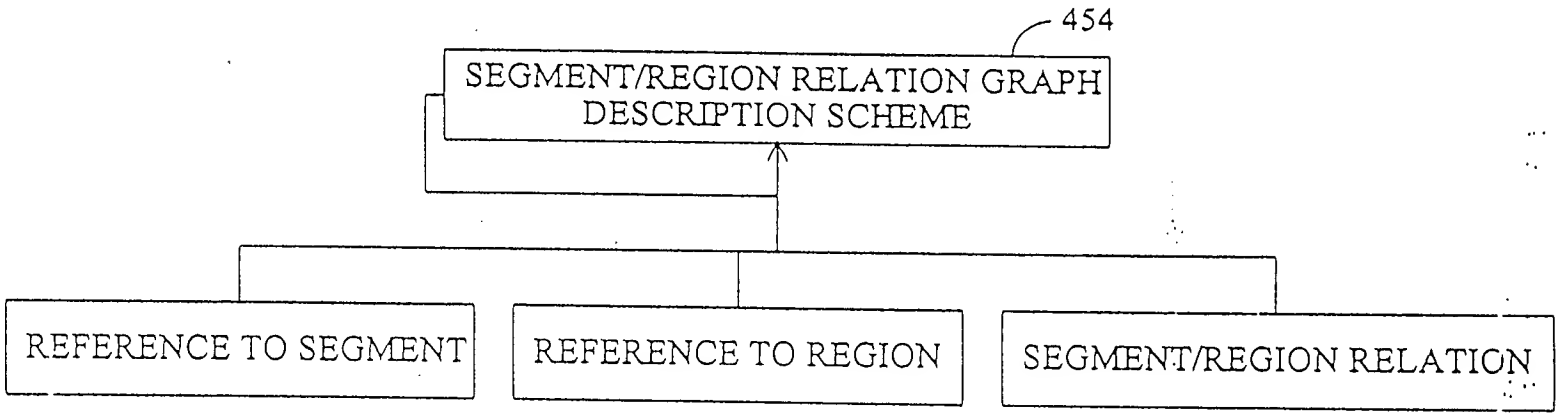

454
SEGMENT/REGION RELATION GRAPH DESCRIPTION SCHEME
REFERENCE TO SEGMENT
REFERENCE TO REGION
SEGMENT/REGION RELATION

FIG. 18

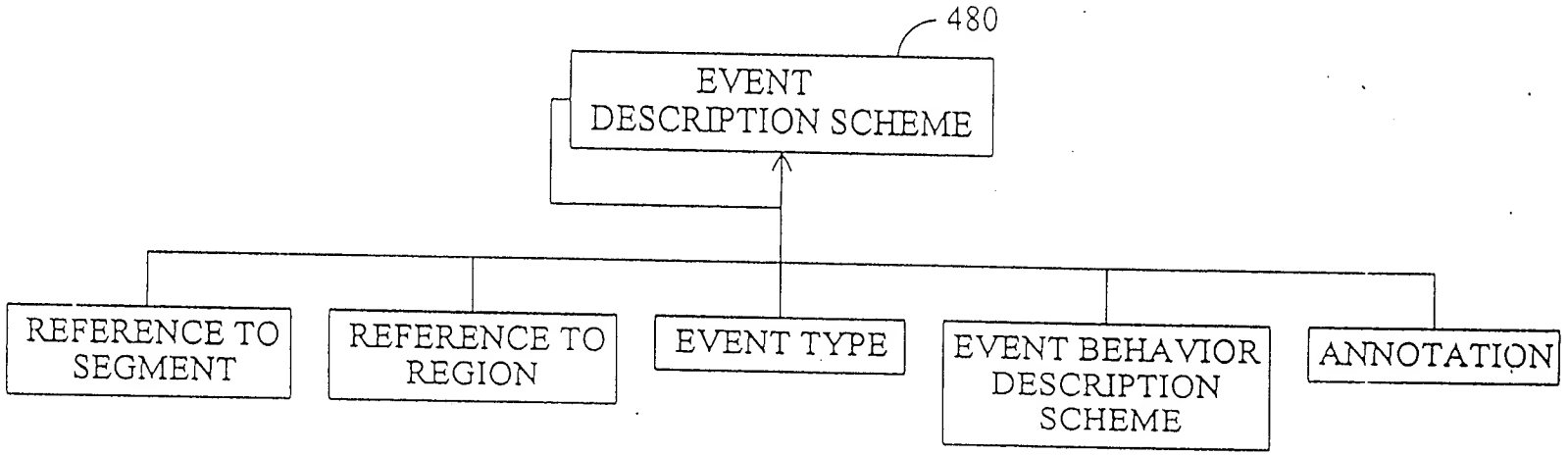

480
EVENT DESCRIPTION SCHEME
REFERENCE TO SEGMENT
REFERENCE TO REGION
EVENT TYPE
EVENT BEHAVIOR DESCRIPTION SCHEME
ANNOTATION

FIG. 19

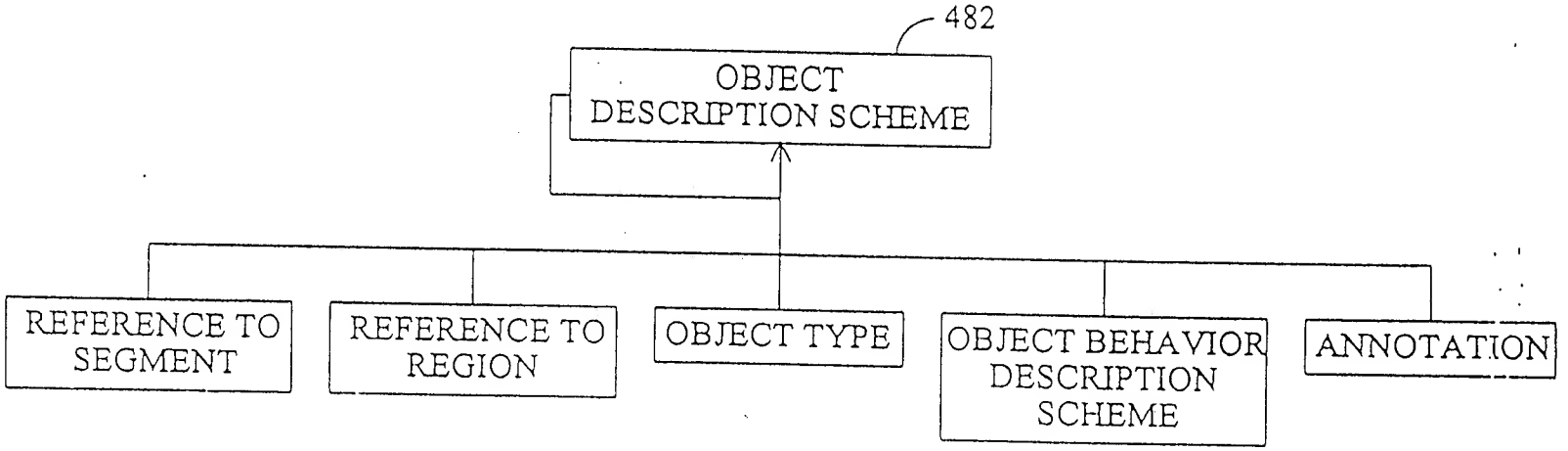

482
OBJECT DESCRIPTION SCHEME
REFERENCE TO SEGMENT
REFERENCE TO REGION
OBJECT TYPE
OBJECT BEHAVIOR DESCRIPTION SCHEME
ANNOTATION

FIG. 20

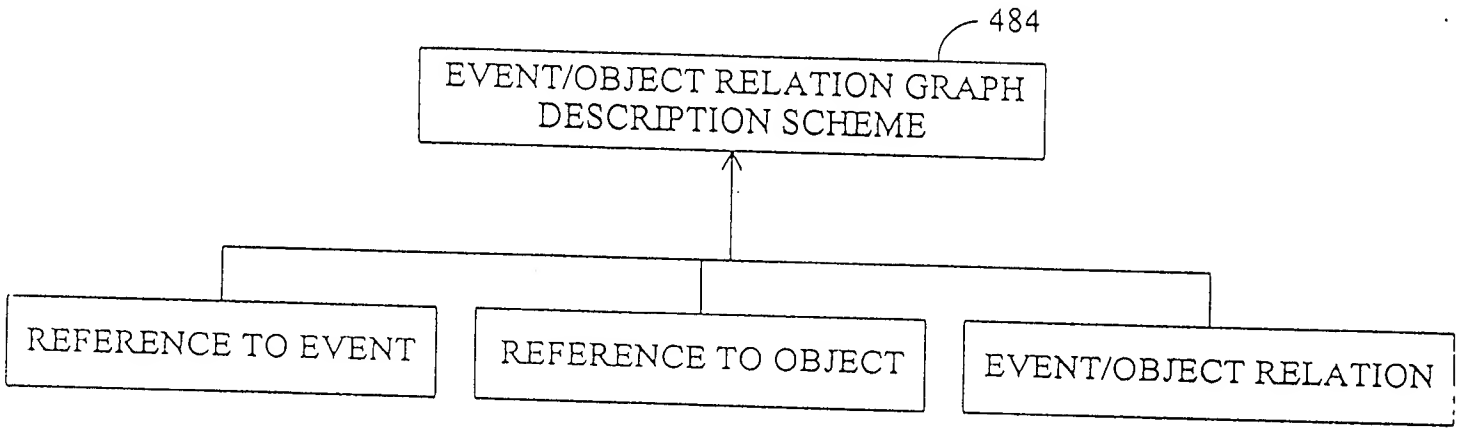

484
EVENT/OBJECT RELATION GRAPH DESCRIPTION SCHEME
REFERENCE TO EVENT
REFERENCE TO OBJECT
EVENT/OBJECT RELATION

FIG. 21

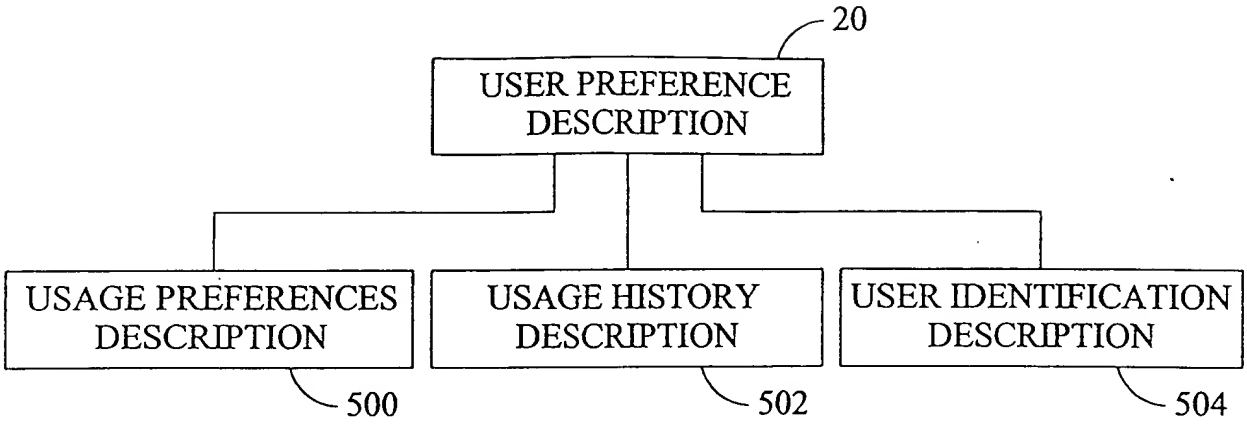


FIG. 22

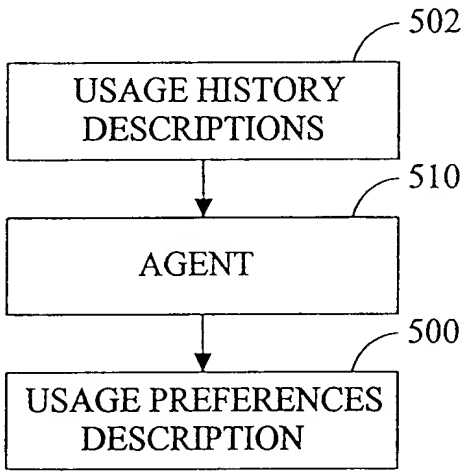


FIG. 23

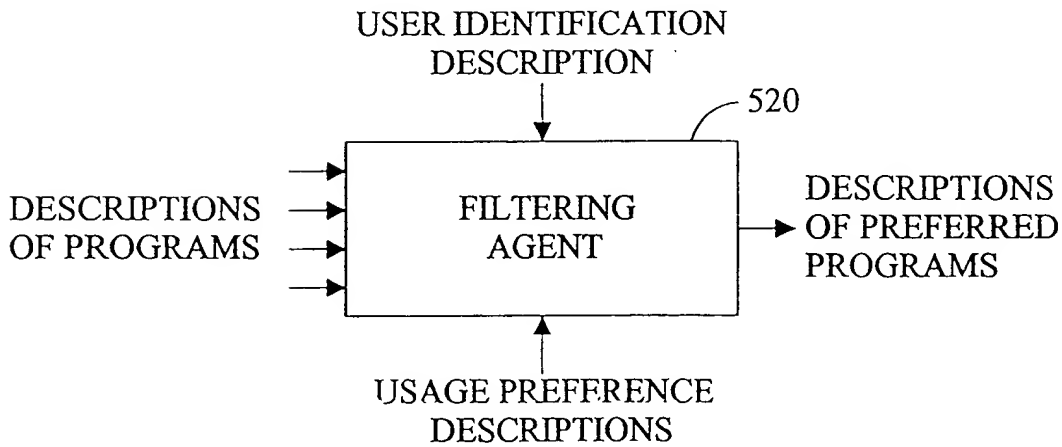


FIG. 24

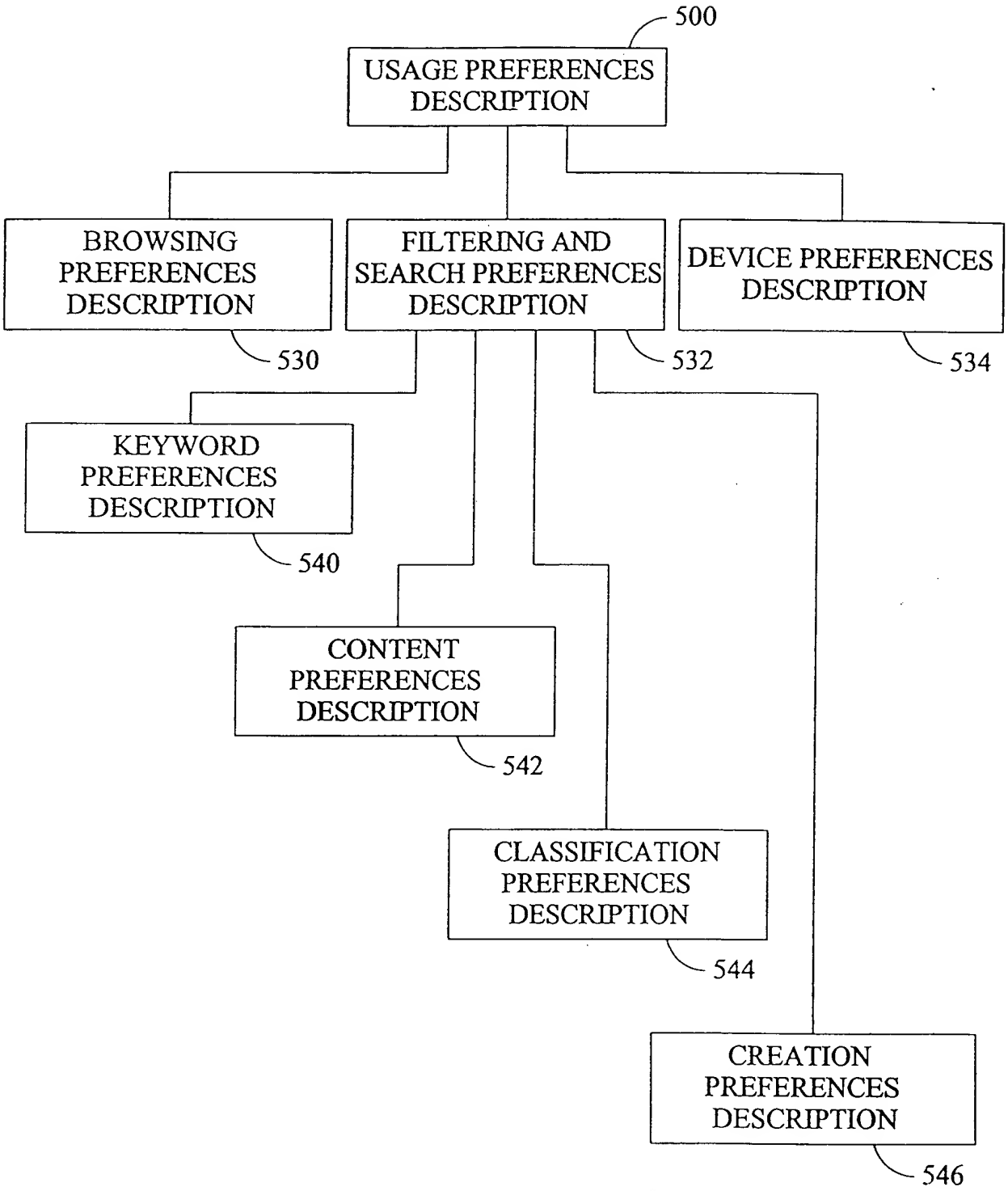

500
USAGE PREFERENCES DESCRIPTION
BROWSING PREFERENCES DESCRIPTION
530
FILTERING AND SEARCH PREFERENCES DESCRIPTION
532
DEVICE PREFERENCES DESCRIPTION
534
KEYWORD PREFERENCES DESCRIPTION
540
CONTENT PREFERENCES DESCRIPTION
542
CLASSIFICATION PREFERENCES DESCRIPTION
544
CREATION PREFERENCES DESCRIPTION
546

FIG. 25

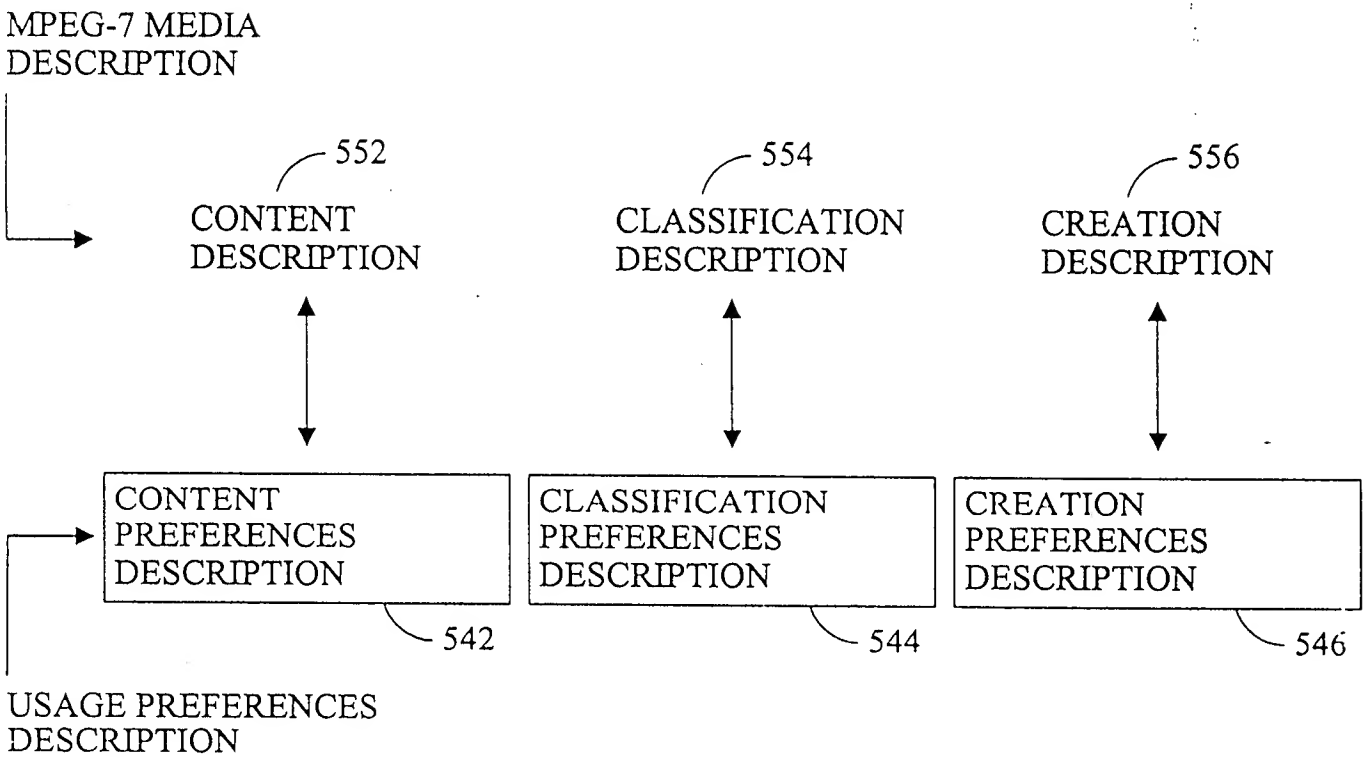

MPEG-7 MEDIA DESCRIPTION
552
CONTENT DESCRIPTION
554
CLASSIFICATION DESCRIPTION
556
CREATION DESCRIPTION
CONTENT PREFERENCES DESCRIPTION
542
CLASSIFICATION PREFERENCES DESCRIPTION
544
CREATION PREFERENCES DESCRIPTION
546
USAGE PREFERENCES DESCRIPTION

FIG. 26

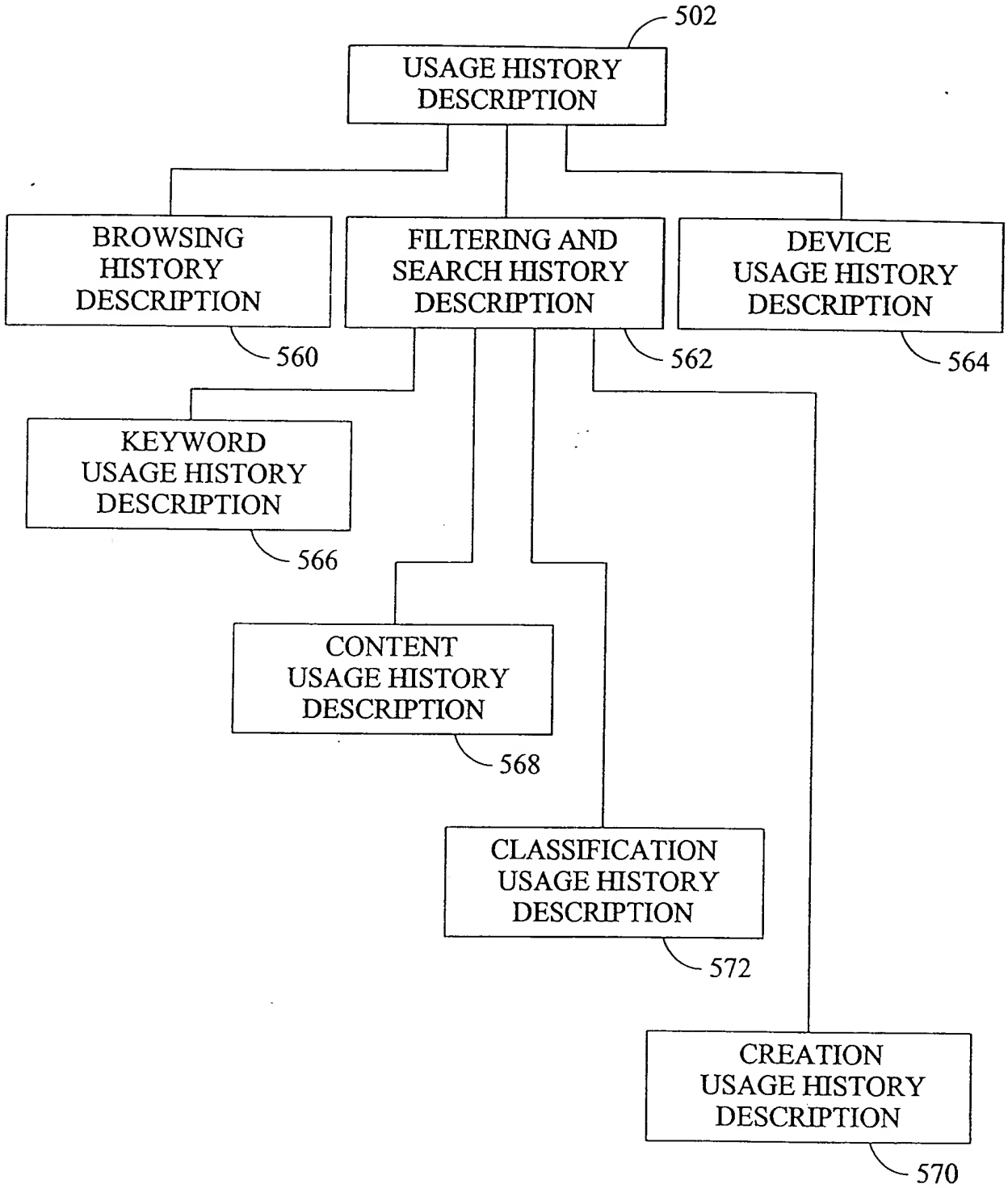

502
USAGE HISTORY DESCRIPTION
BROWSING HISTORY DESCRIPTION
560
FILTERING AND SEARCH HISTORY DESCRIPTION
562
DEVICE USAGE HISTORY DESCRIPTION
564
KEYWORD USAGE HISTORY DESCRIPTION
566
CONTENT USAGE HISTORY DESCRIPTION
568
CLASSIFICATION USAGE HISTORY DESCRIPTION
572
CREATION USAGE HISTORY DESCRIPTION
570

FIG. 27

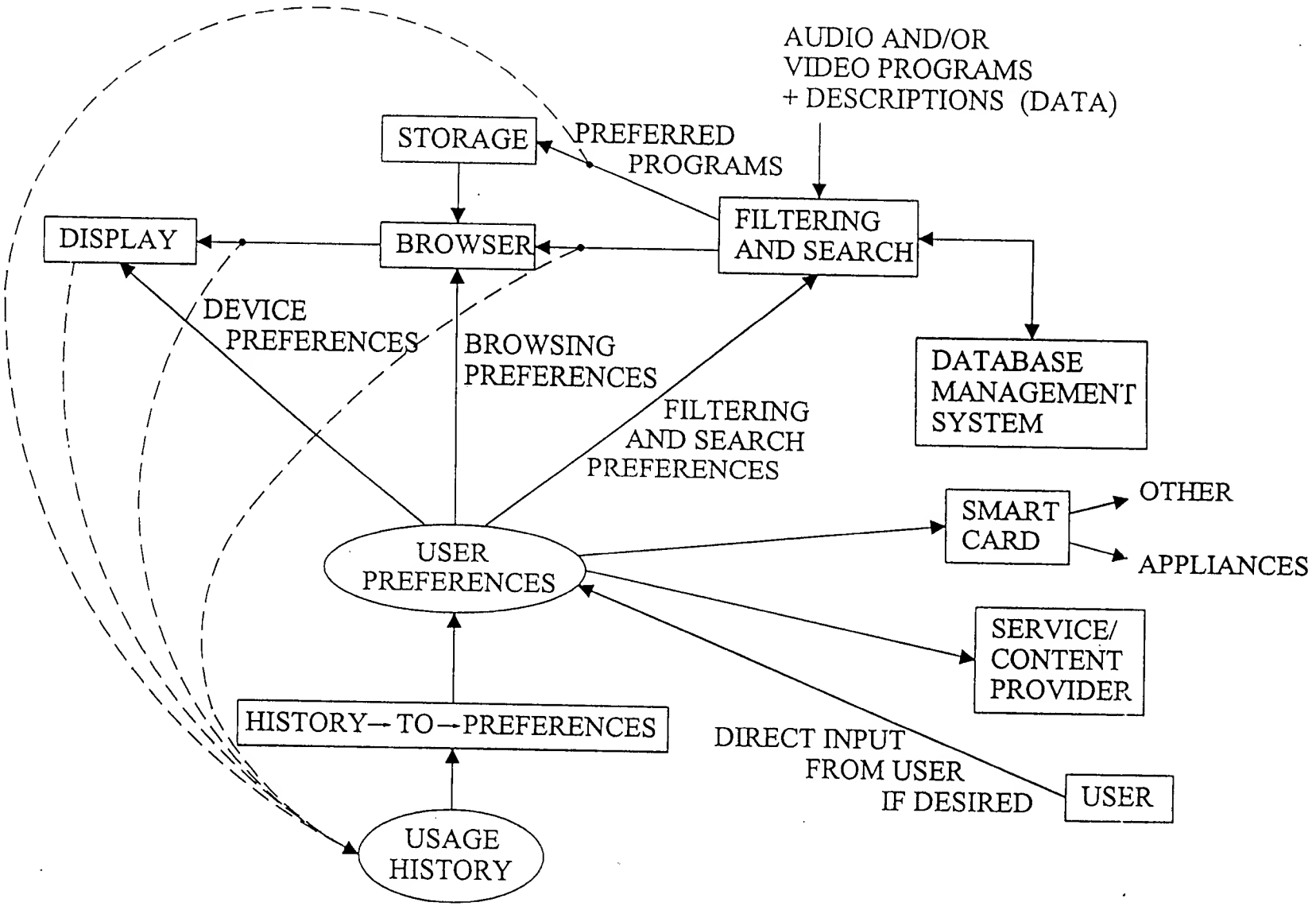

AUDIO AND/OR
VIDEO PROGRAMS
+ DESCRIPTIONS (DATA)
STORAGE
PREFERRED
PROGRAMS
DISPLAY
BROWSER
FILTERING
AND SEARCH
DEVICE
PREFERENCES
BROWSING
PREFERENCES
FILTERING
AND SEARCH
PREFERENCES
DATABASE
MANAGEMENT
SYSTEM
SMART
CARD
OTHER
APPLIANCES
USER
PREFERENCES
SERVICE/
CONTENT
PROVIDER
HISTORY—TO—PREFERENCES
DIRECT INPUT
FROM USER
IF DESIRED
USER
USAGE
HISTORY

FIG. 28

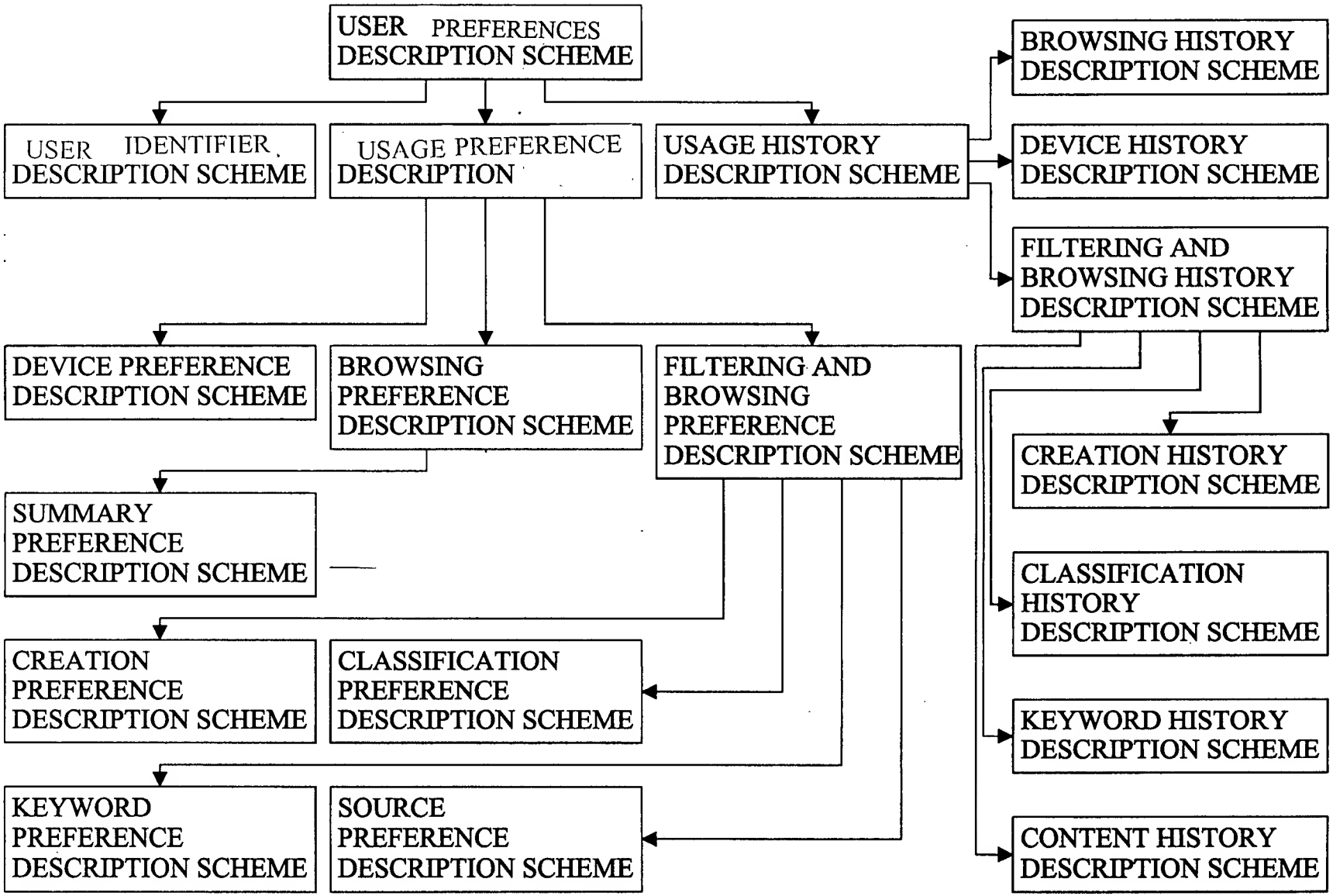

USER PREFERENCES DESCRIPTION SCHEME
USER IDENTIFIER DESCRIPTION SCHEME
USAGE PREFERENCE DESCRIPTION
USAGE HISTORY DESCRIPTION SCHEME
BROWSING HISTORY DESCRIPTION SCHEME
DEVICE HISTORY DESCRIPTION SCHEME
FILTERING AND BROWSING HISTORY DESCRIPTION SCHEME
DEVICE PREFERENCE DESCRIPTION SCHEME
BROWSING PREFERENCE DESCRIPTION SCHEME
FILTERING AND BROWSING PREFERENCE DESCRIPTION SCHEME
CREATION HISTORY DESCRIPTION SCHEME
SUMMARY PREFERENCE DESCRIPTION SCHEME
CLASSIFICATION HISTORY DESCRIPTION SCHEME
CREATION PREFERENCE DESCRIPTION SCHEME
CLASSIFICATION PREFERENCE DESCRIPTION SCHEME
KEYWORD HISTORY DESCRIPTION SCHEME
KEYWORD PREFERENCE DESCRIPTION SCHEME
SOURCE PREFERENCE DESCRIPTION SCHEME
CONTENT HISTORY DESCRIPTION SCHEME

FIG. 29

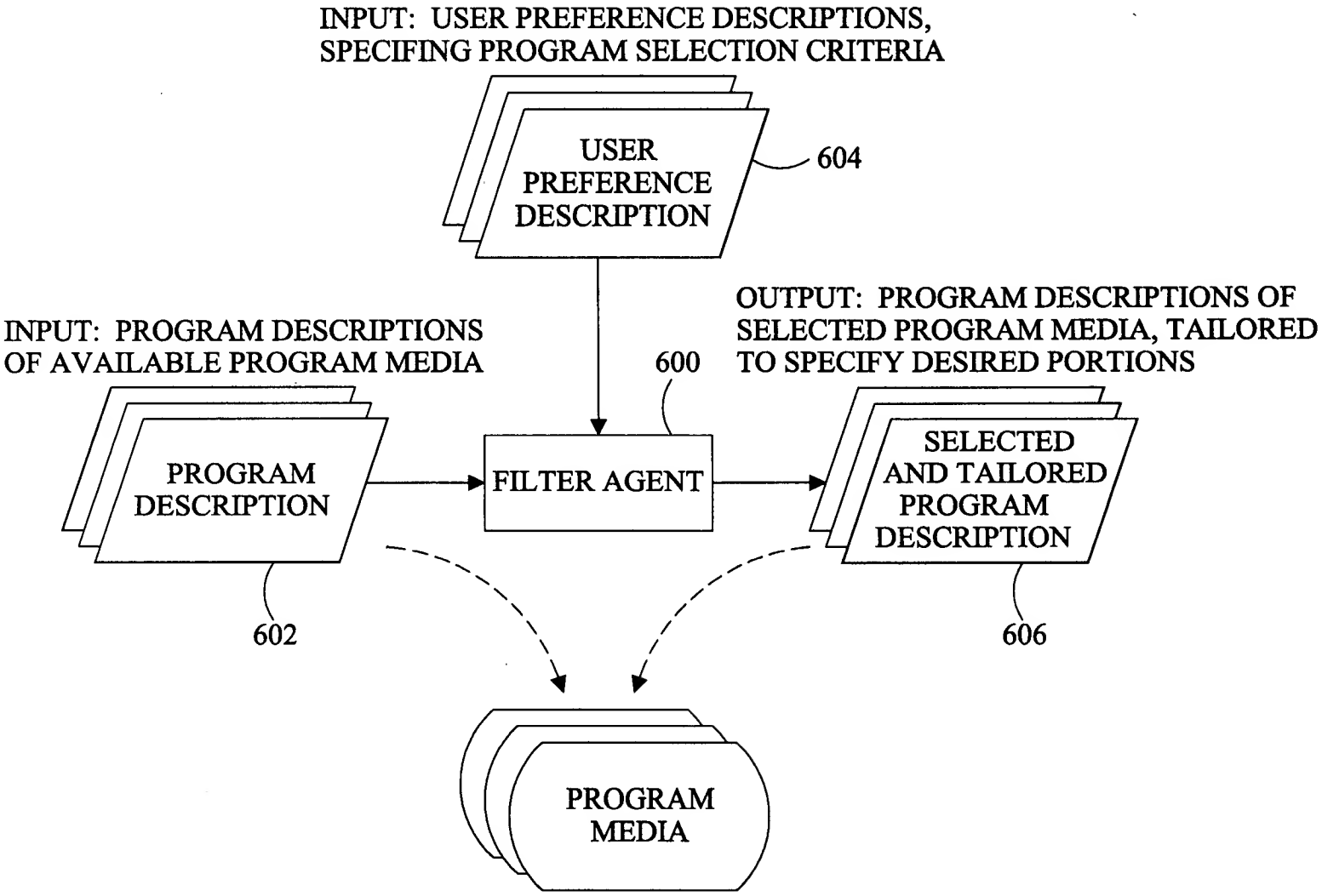
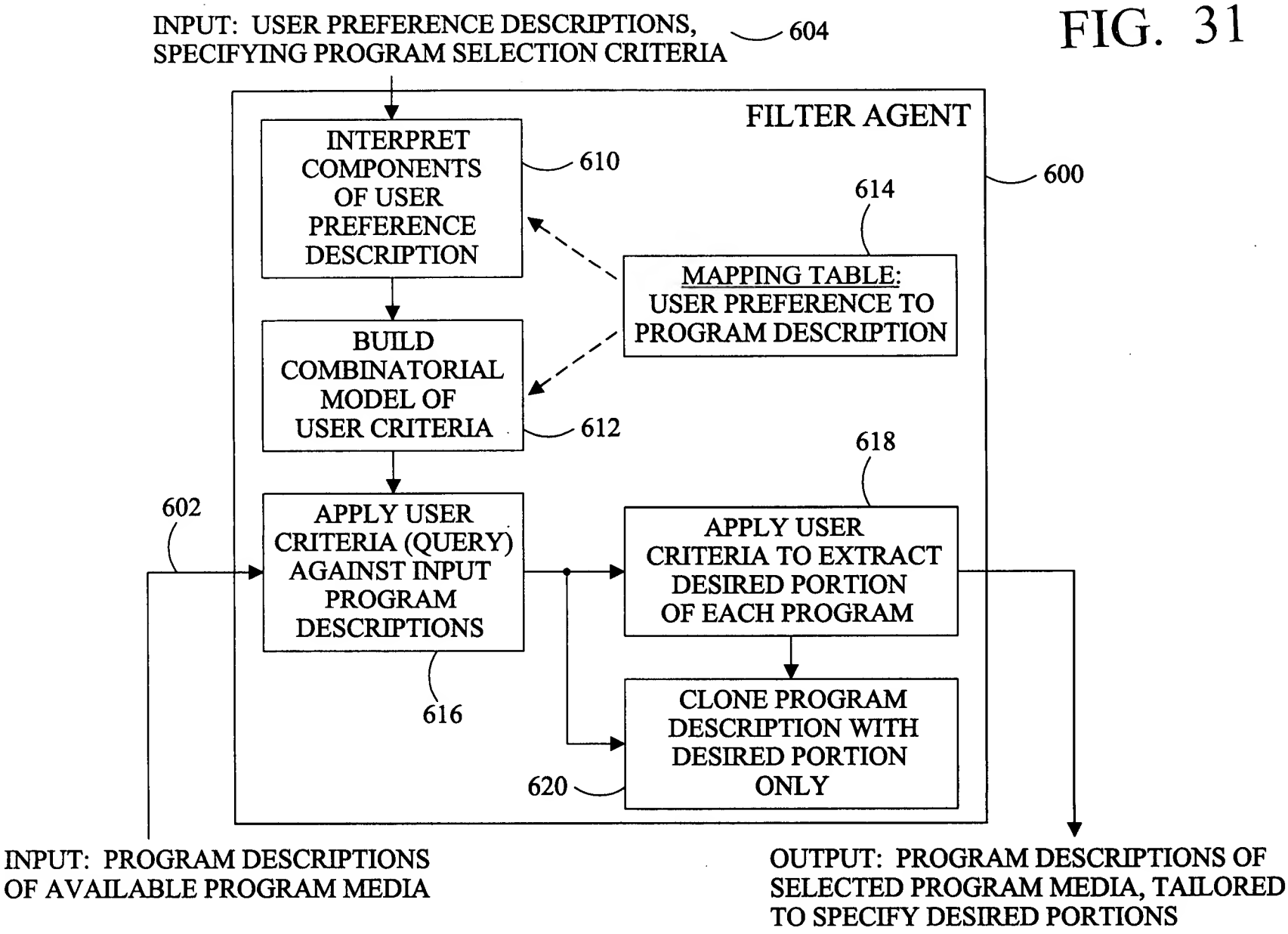

INPUT: USER PREFERENCE DESCRIPTIONS, SPECIFING PROGRAM SELECTION CRITERIA
USER PREFERENCE DESCRIPTION
604
INPUT: PROGRAM DESCRIPTIONS OF AVAILABLE PROGRAM MEDIA
600
OUTPUT: PROGRAM DESCRIPTIONS OF SELECTED PROGRAM MEDIA, TAILORED TO SPECIFY DESIRED PORTIONS
PROGRAM DESCRIPTION
FILTER AGENT
SELECTED AND TAILORED PROGRAM DESCRIPTION
602
606
PROGRAM MEDIA

FIG. 30

FIG. 31


INPUT: USER PREFERENCE DESCRIPTIONS, SPECIFYING PROGRAM SELECTION CRITERIA
604
FILTER AGENT
600
INTERPRET COMPONENTS OF USER PREFERENCE DESCRIPTION
610
614
MAPPING TABLE: USER PREFERENCE TO PROGRAM DESCRIPTION
BUILD COMBINATORIAL MODEL OF USER CRITERIA
612
618
602
APPLY USER CRITERIA (QUERY) AGAINST INPUT PROGRAM DESCRIPTIONS
APPLY USER CRITERIA TO EXTRACT DESIRED PORTION OF EACH PROGRAM
616
CLONE PROGRAM DESCRIPTION WITH DESIRED PORTION ONLY
620
INPUT: PROGRAM DESCRIPTIONS OF AVAILABLE PROGRAM MEDIA
OUTPUT: PROGRAM DESCRIPTIONS OF SELECTED PROGRAM MEDIA, TAILORED TO SPECIFY DESIRED PORTIONS

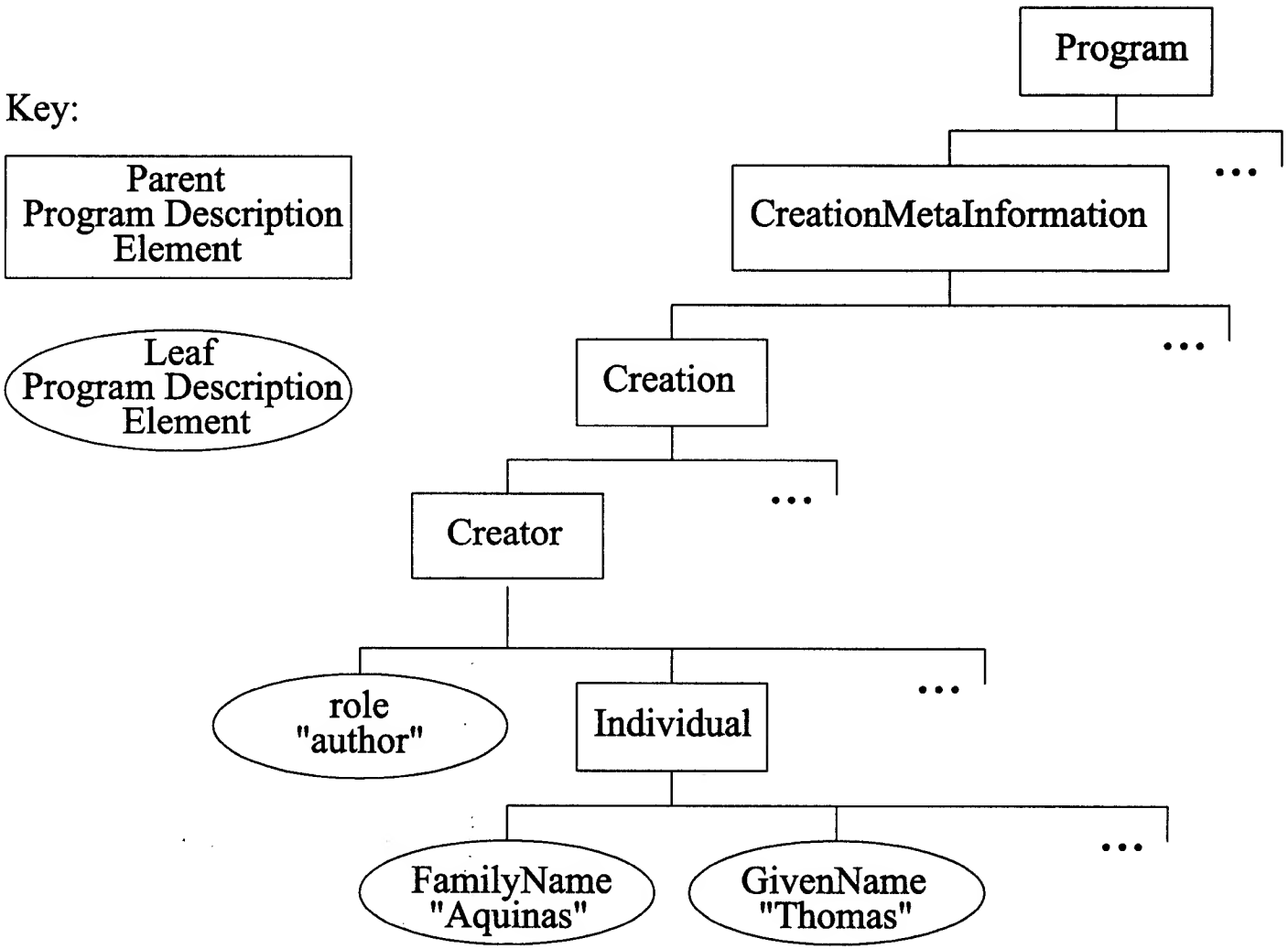

Key:
Parent Program Description Element
Leaf Program Description Element
Program
CreationMetaInformation
Creation
Creator
role "author"
Individual
FamilyName "Aquinas"
GivenName "Thomas"
...

FIG. 32

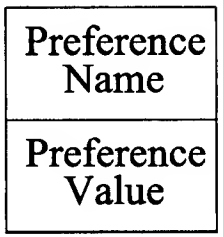

Individual Preference
Preference Name
Preference Value

FIG. 33

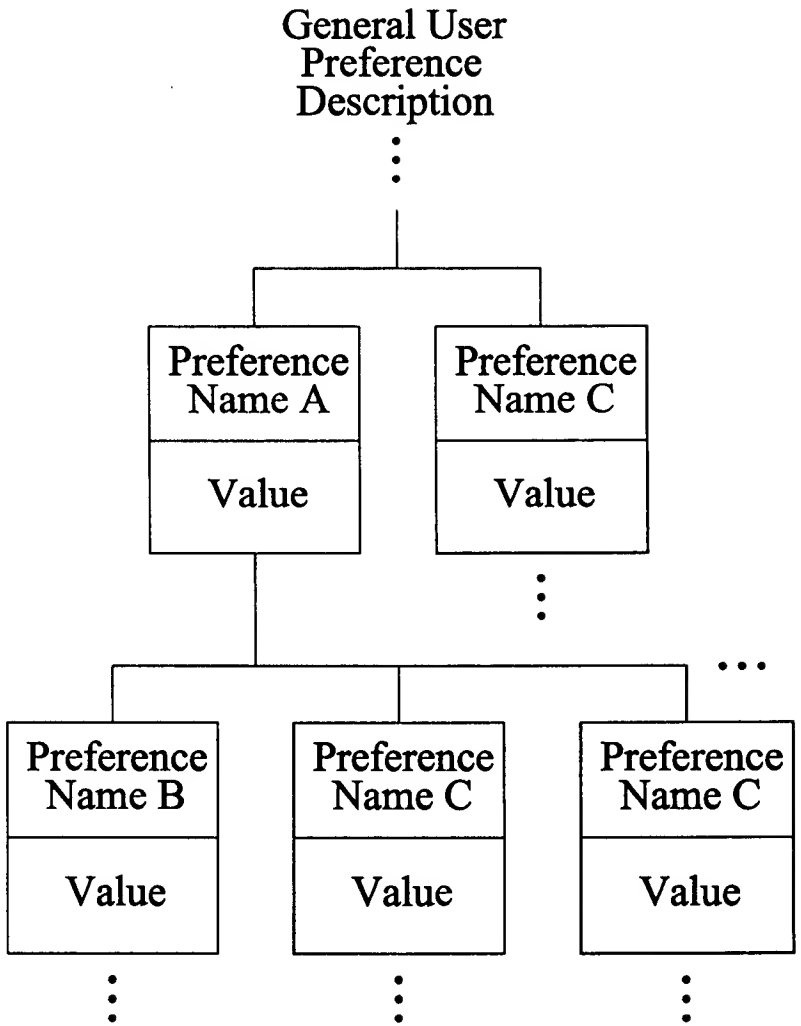

General User Preference Description
Preference Name A
Value
Preference Name C
Value
Preference Name B
Value
Preference Name C
Value
Preference Name C
Value

FIG. 34

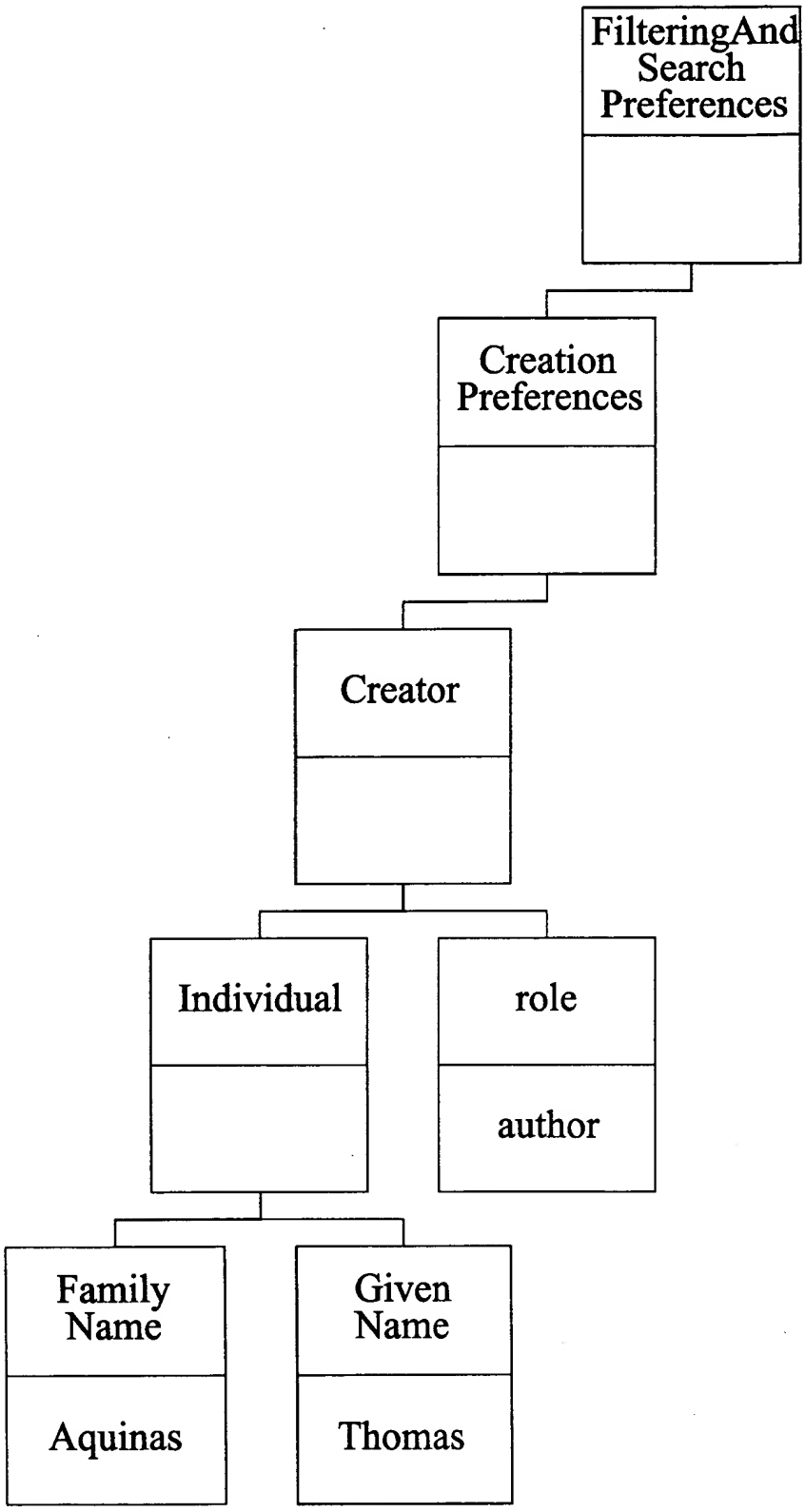

FilteringAnd Search Preferences
Creation Preferences
Creator
Individual
role
author
Family Name
Aquinas
Given Name
Thomas

FIG. 35

Name	Location	TestOp	InterOp	IntraOp
FilteringAndSearch Preferences/ CreationPreferences	/Program /*CreationMetaInformation /*Creation	match-case-insens	AND	AND
Creator/role	//*Creator/role	NULL	CAND	OR
Creator/Individual/ FamilyName	//*Creator/Individual /FamilyName	substring-case-insens	CAND	OR
Creator/Individual/ GivenName	//*Creator/Individual /*GivenName	substring-case-insens	CAND	OR

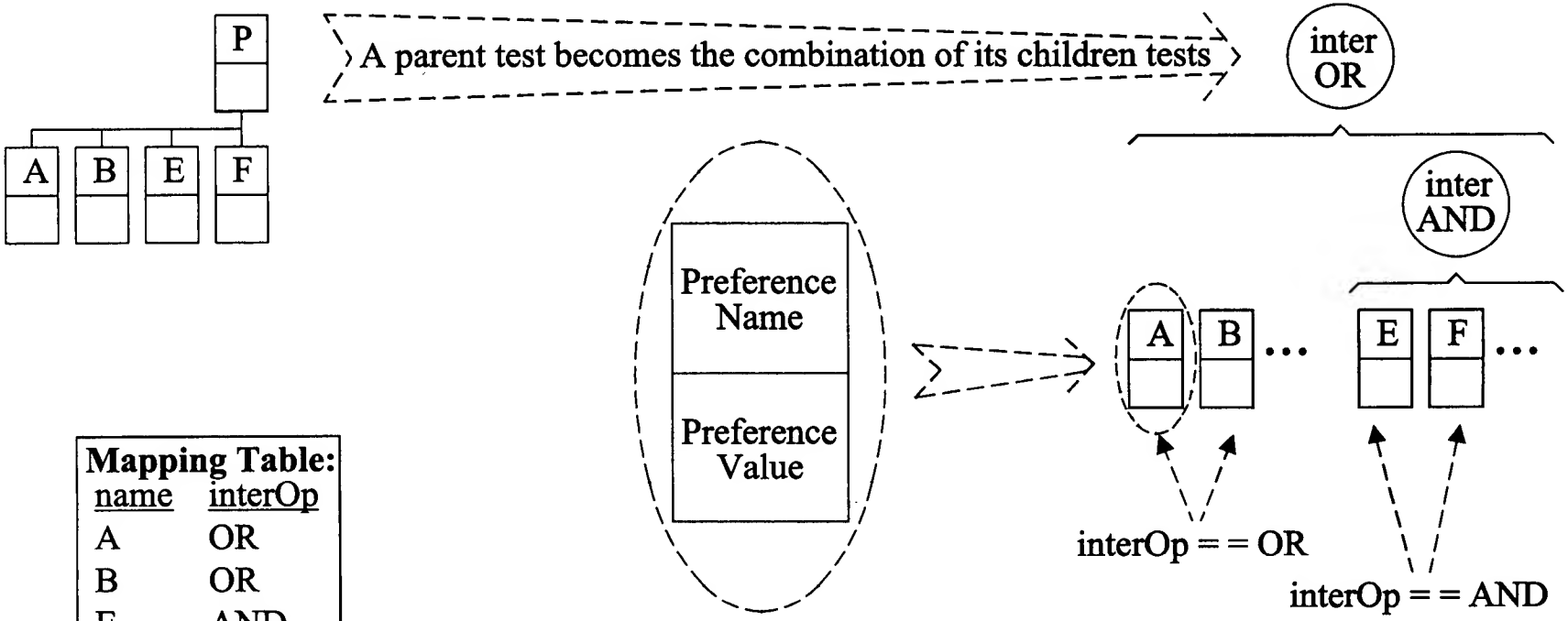
FIG. 36

Test Operator	Description
substring-case-insensitive	Test that the preference value string [is a substring of] / [matches] the Program Description element value, [with] / [without] being case sensitive.
substring-case-sensitive	
string-match-case-insensitive	
string-match-case-sensitive	
value-less-than	Test that the Program Description element value converted to a number is [<, < = >, > =, = =, > <, > = < =, ~] the preference value converted to number[s]. In the case of range tests (> <, > = < =), the preference value is assumed to be a pair of comma-delimited numbers. The approximate operator may have a second number describing the rolloff form the target number.
value-less-than-or-equal	
value-greater-than	
value-greater-than-or-equal	
value-equal	
value-greater-than-less-than	
value-greater-than-equal-less-than-equal	
value-approximately	
count-less-than	Test that the quantity of Program Description elements is [<, < >, >, = =, > <, ~] the preference value converted to number[s]. In the case of range tests (> <), the preference value is assumed to be a pair of comma-delimited numbers. The approximate operator may have a second number describing the rolloff from the target number.
count-greater-than	
count-equal	
count-greater-than-less-than	
count-approximately	

FIG. 37

Combinatorial Operator	Description
AND	The result of this Individual Preference test is boolean ANDed with others. If all the results in this combination are non-zero, the combined result is one, otherwise zero.
OR	The result of this Individual Preference test is boolean ORed with others. If any of the results in this combination are non-zero, the combined result is one, otherwise zero.
CAND	The Individual Preferences in this combination are evaluated form a Constrained common node. If all the results in this combination are non-zero, the combined result is one, otherwise zero.
MAX	The result of this Individual Preference test is combined arithmetically in a Maximum function with others. The combined result is the largest of all the results in this combination.
MIN	The result of this Individual Preference test is combined arithmetically in a Minimum function with others. The combined result is the smallest of all the results in this combination.
PROD	The result of this Individual Preference test is combined arithmetically in a Product function with others. The combined result is the product of all the results in this combination.
SAND	The result of this Individual Preference test is fuzzy ANDed with others. The combined result is the product of all the fuzzy-transformed (mapped to an S-curve profile) results.
SUM	The result of this Individual Preference test is combined arithmetically in a Sum function with others. The combined result is the sum of all the results in this combination. The result may be further bounded to a maximum result value.
FREQ	The result of this Individual Preference test is boolean counted with others, and the sum is normalized. The combined result is the count of all non-zero results, divided by a fixed maximum frequency number. The result may be further bounded to a maximum result value.
RATIO	The result of this Individual Preference test is boolean counted with others, and the sum is normalized by the number of Individual Preference tests in this combination. The combined result is the count of all non-zero results, divided by the count of all results.

FIG. 38



Mapping Table:

name	interOp
A	OR
B	OR
E	AND
F	AND

A single leaf Test is composed of:

mapped location	reference point in ProgramDS
mapped operation	comparison to be performed
query value	right operand of comparison

For example:

mapped location	/Program/CreationmetaInformation/ Title/TitleText
mapped operation	string_equals
query value	"Westside Story"

FIG. 39

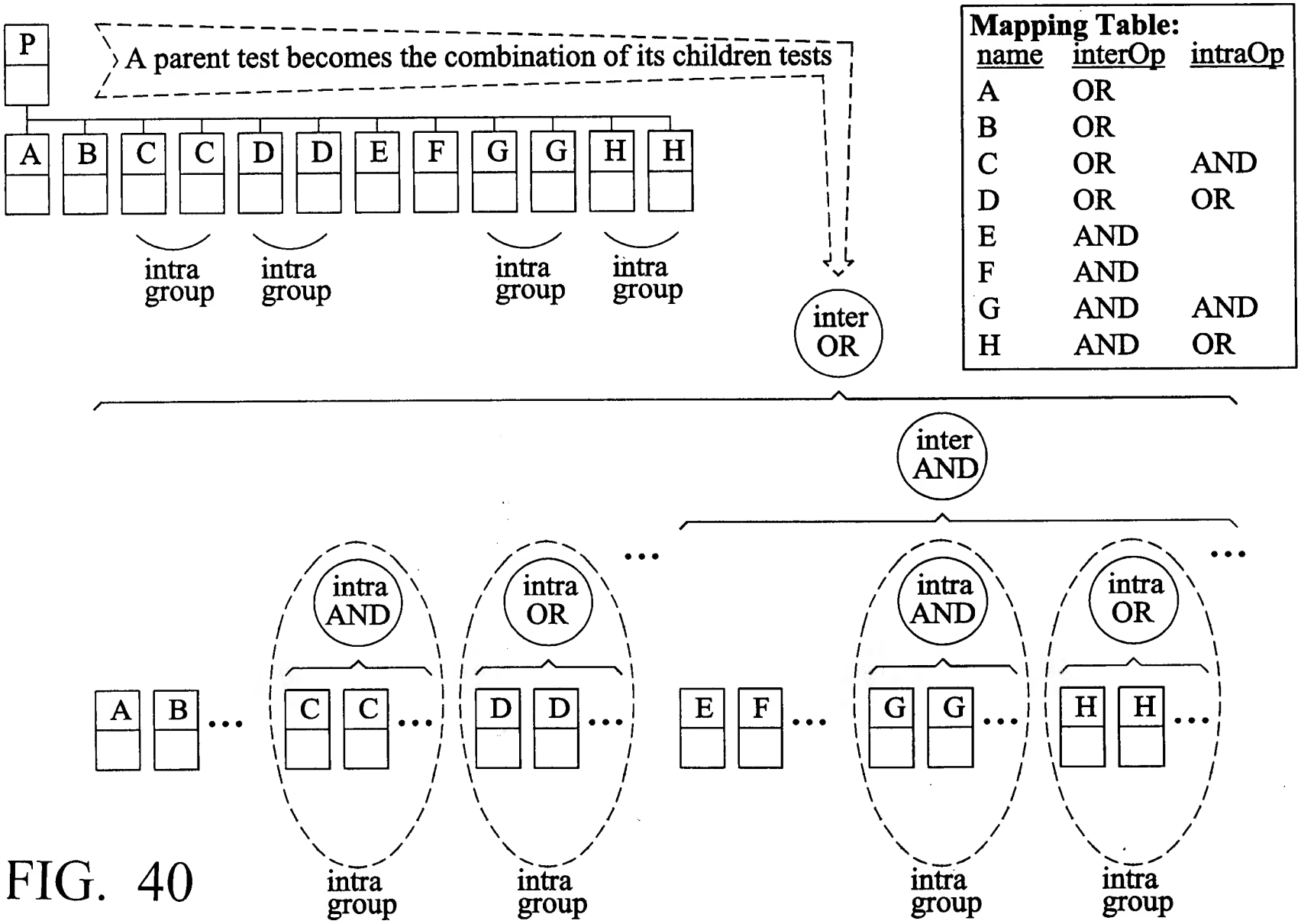
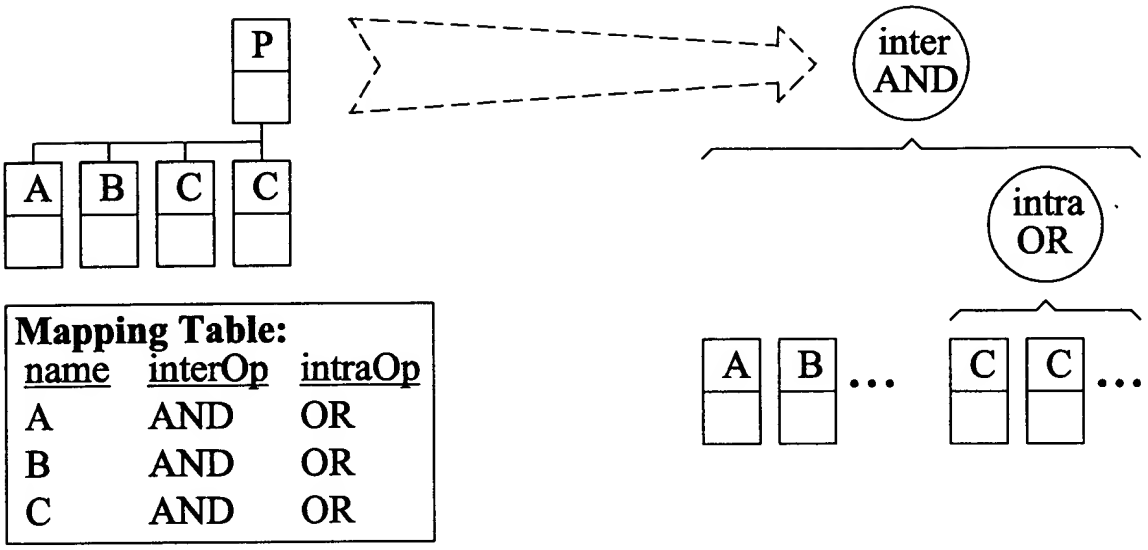

P
A parent test becomes the combination of its children tests
A B C C D D E F G G H H
intra group
intra group
intra group
intra group
inter OR
Mapping Table:
name interOp intraOp
A OR
B OR
C OR AND
D OR OR
E AND
F AND
G AND AND
H AND OR
inter AND
intra AND
intra OR
intra AND
intra OR
A B
C C
D D
E F
G G
H H
intra group
intra group
intra group
intra group

FIG. 40



Mapping Table:

name	interOp	intraOp
A	AND	OR
B	AND	OR
C	AND	OR

FIG. 41

Mapping Table:

name	interOp	intraOp
R (root)	AND	OR
D	AND	AND
P (parent)	AND	OR
A	AND	OR
B	AND	OR

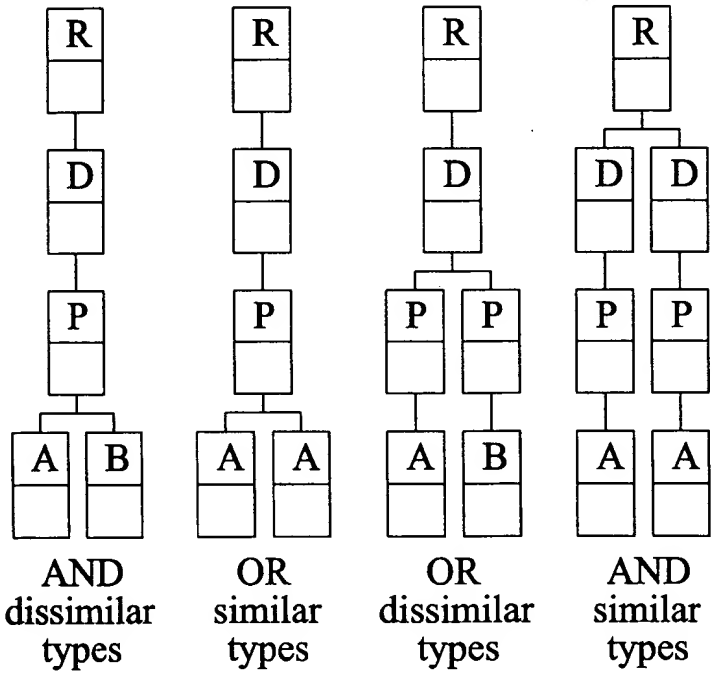
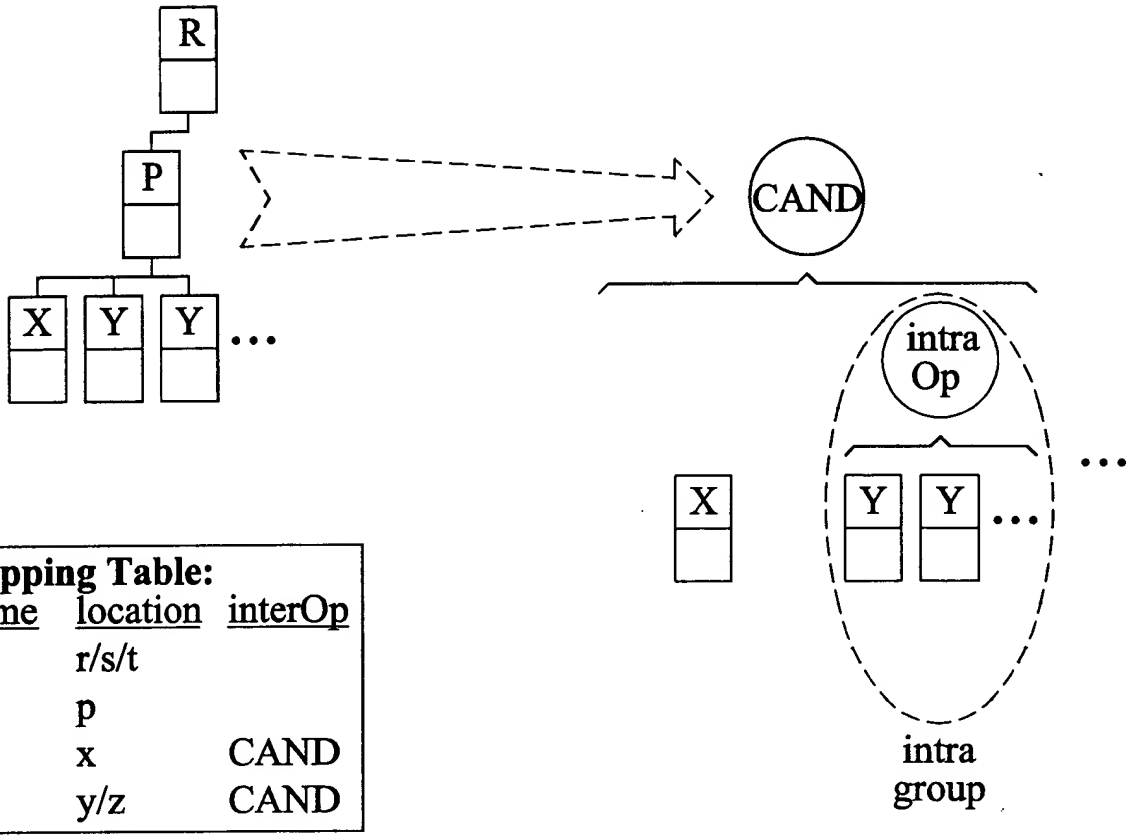


FIG. 42

User Preference Description



Mapping Table:

name	location	interOp
R	r/s/t	
P	p	
X	x	CAND
Y	y/z	CAND

Program Description

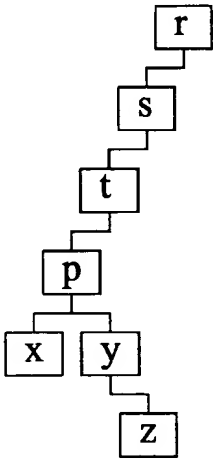
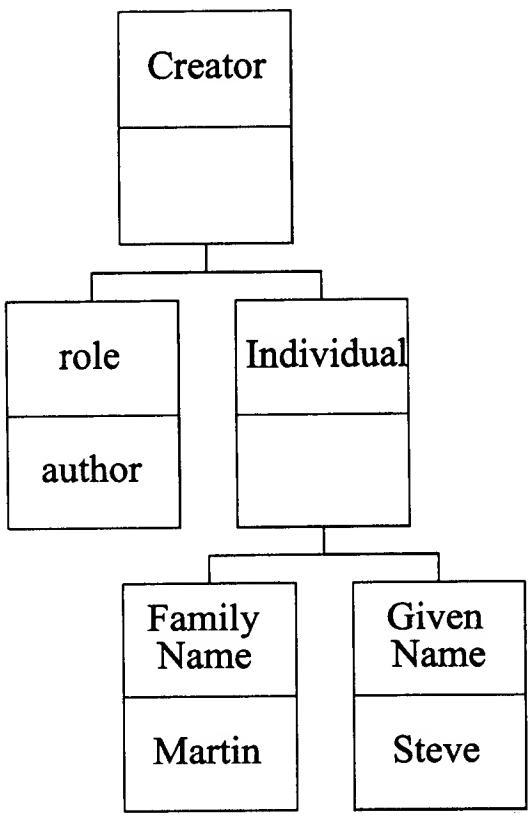


FIG. 43


Creator
role
author
Individual
Family Name
Martin
Given Name
Steve

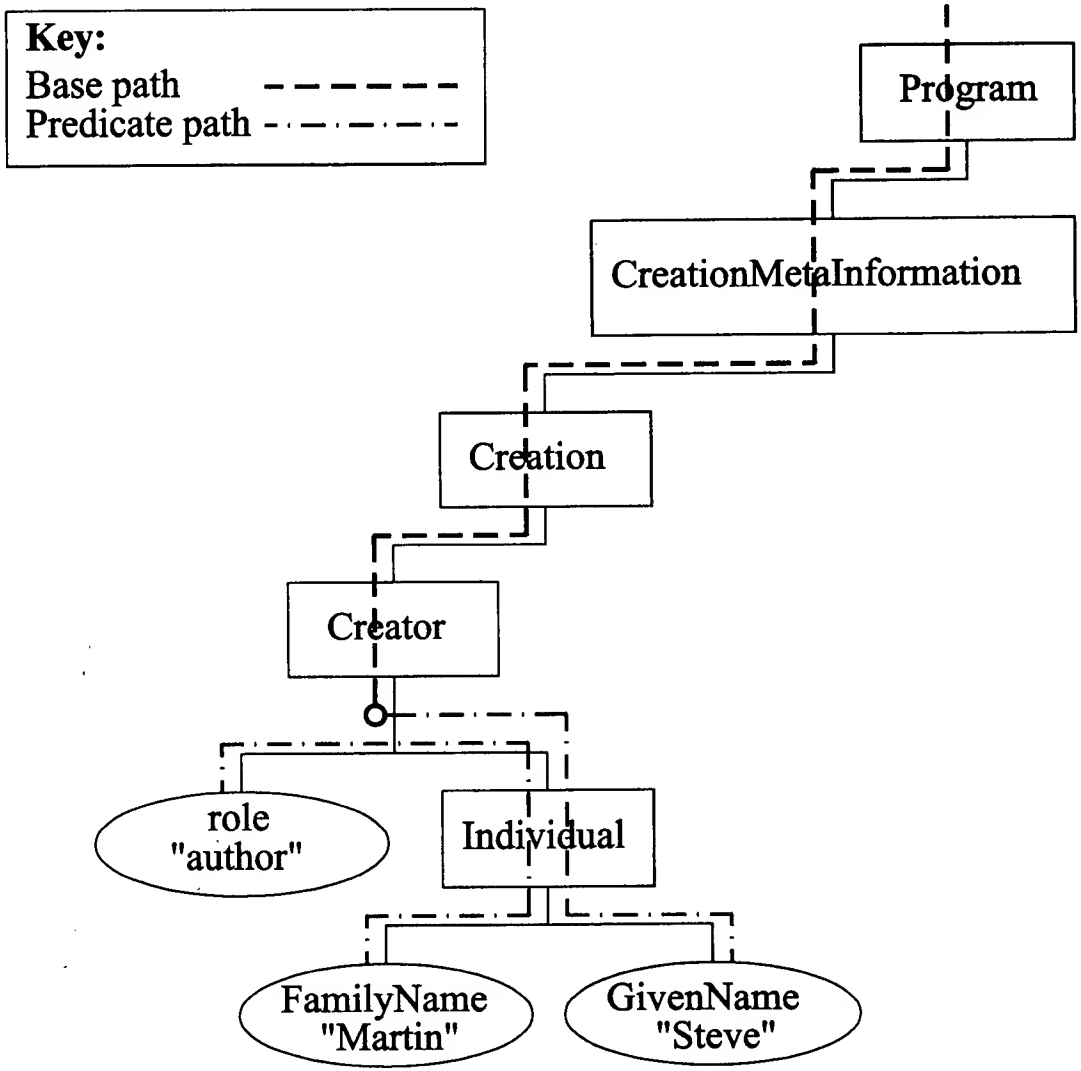

Key:
Base path
Predicate path
Program
CreationMetaInformation
Creation
Creator
role "author"
Individual
FamilyName "Martin"
GivenName "Steve"

FIG. 44A

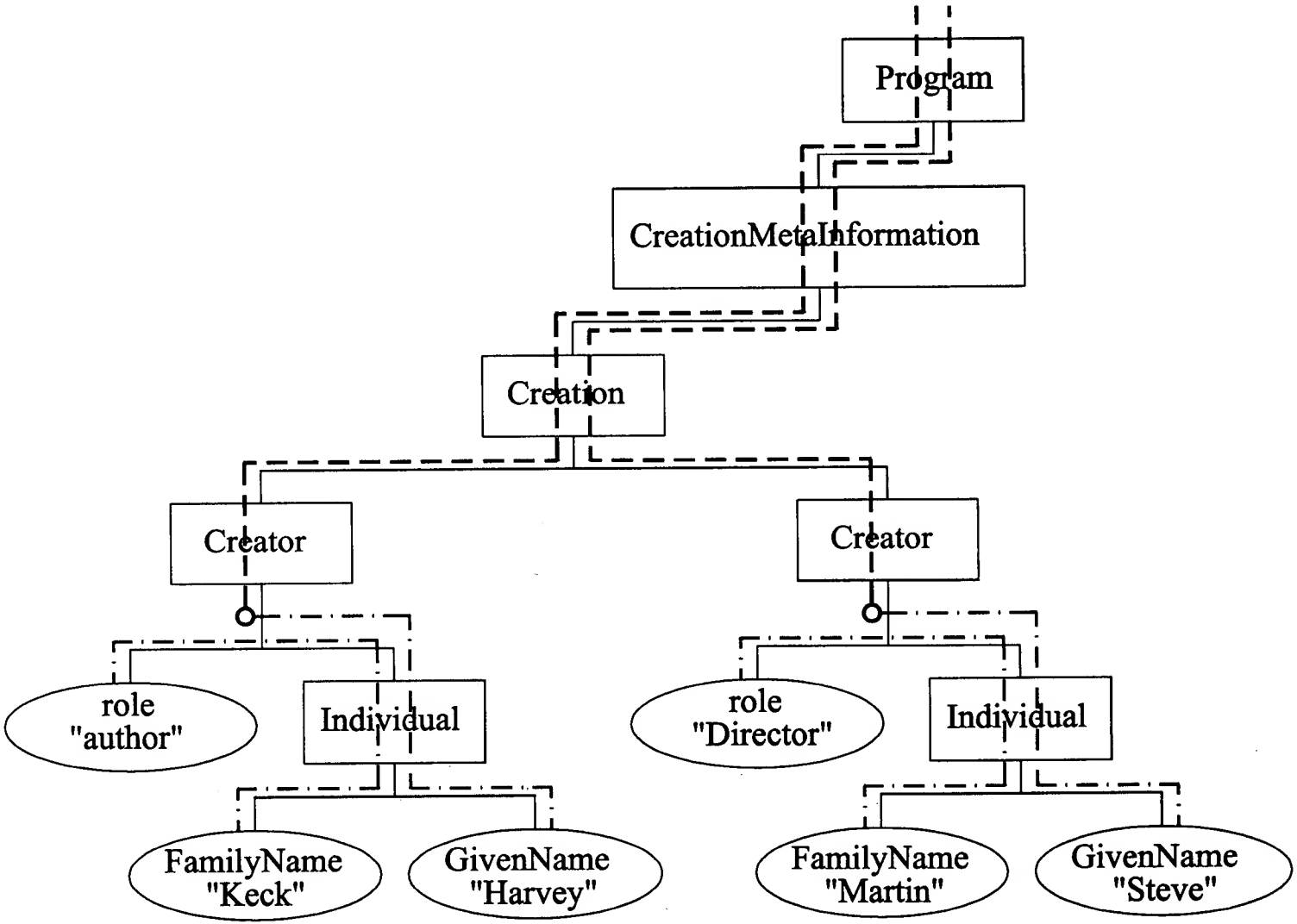

Program
CreationMetaInformation
Creation
Creator
Creator
role
"author"
Individual
role
"Director"
Individual
FamilyName
"Keck"
GivenName
"Harvey"
FamilyName
"Martin"
GivenName
"Steve"

FIG. 44B

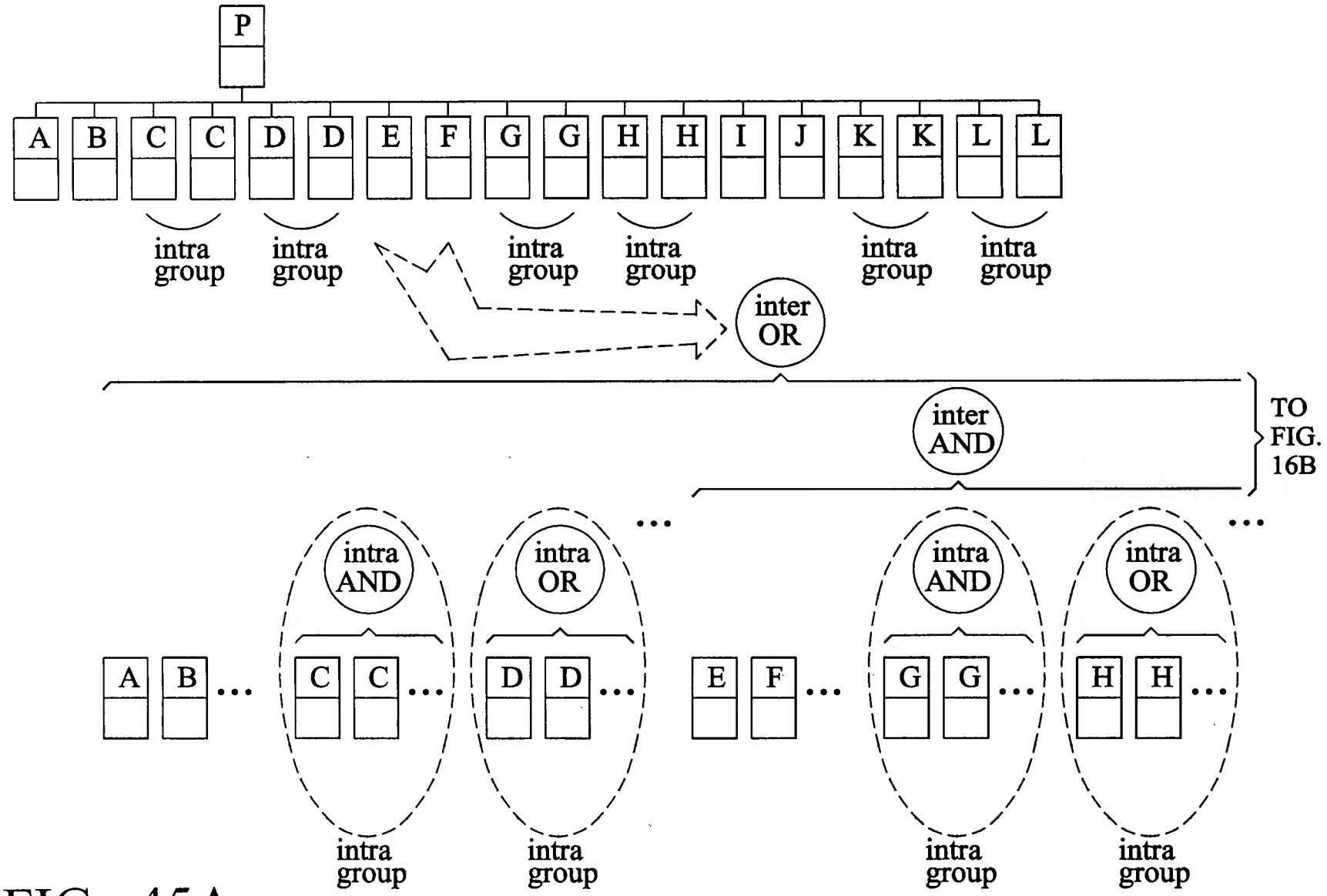
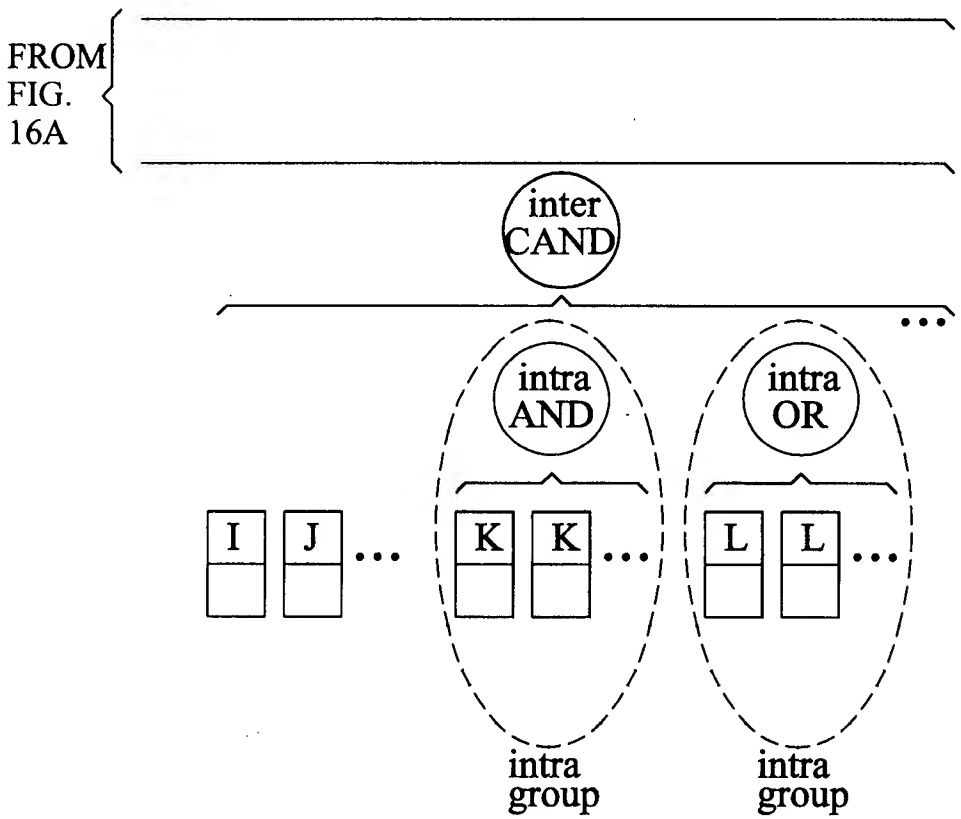

P
A
B
C
C
D
D
E
F
G
G
H
H
I
J
K
K
L
L
intra group
intra group
intra group
intra group
intra group
intra group
inter OR
inter AND
TO FIG. 16B
intra AND
intra OR
intra AND
intra OR
intra group
intra group
intra group
intra group

FIG. 45A



Mapping Table:

name	interOp	intraOp
A	OR	
B	OR	
C	OR	AND
D	OR	OR
E	AND	
F	AND	
G	AND	AND
H	AND	OR
E	CAND	
F	CAND	
G	CAND	AND
H	CAND	OR

FIG. 45B

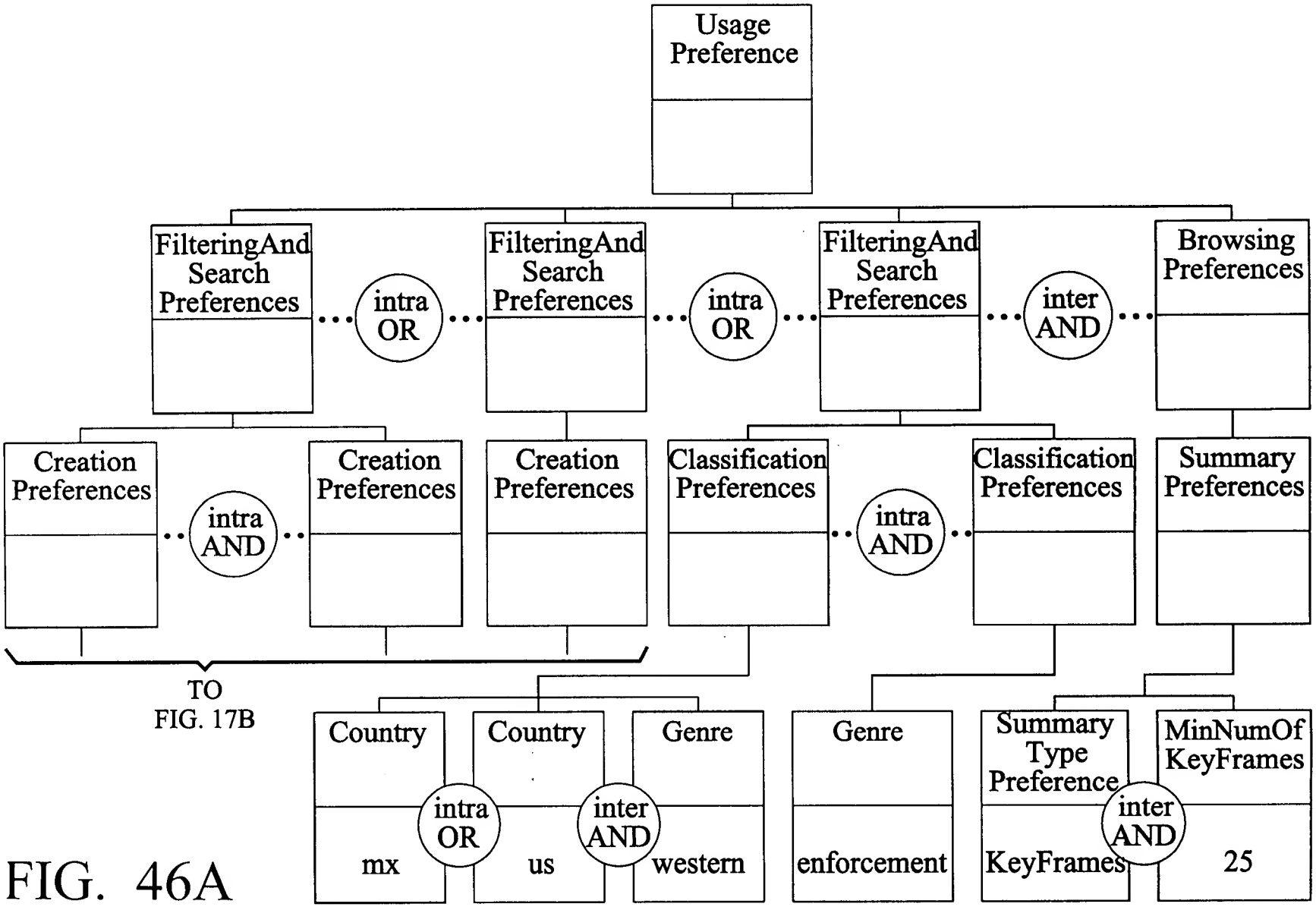

Usage Preference
FilteringAnd Search Preferences
intra OR
FilteringAnd Search Preferences
intra OR
FilteringAnd Search Preferences
inter AND
Browsing Preferences
Creation Preferences
intra AND
Creation Preferences
Creation Preferences
Classification Preferences
intra AND
Classification Preferences
Summary Preferences
TO FIG. 17B
Country
intra OR
mx
Country
inter AND
us
Genre
western
Genre
enforcement
Summary Type Preference
inter AND
KeyFrames
MinNumOf KeyFrames
25

FIG. 46A

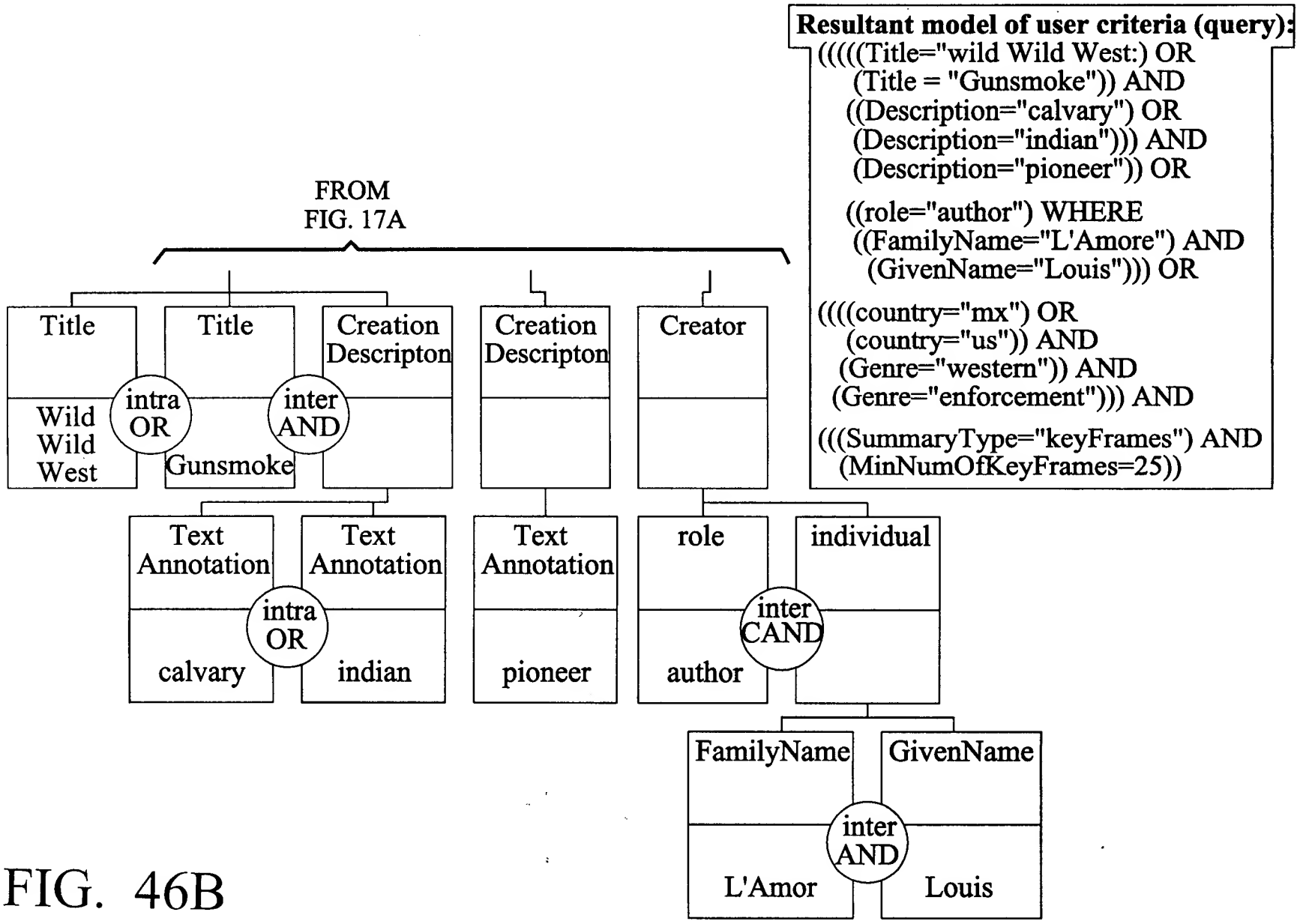

Resultant model of user criteria (query):
((((Title="wild Wild West:) OR
(Title = "Gunsmoke")) AND
((Description="calvary") OR
(Description="indian"))) AND
(Description="pioneer")) OR
((role="author") WHERE
((FamilyName="L'Amore") AND
(GivenName="Louis"))) OR
((((country="mx") OR
(country="us")) AND
(Genre="western")) AND
(Genre="enforcement"))) AND
(((SummaryType="keyFrames") AND
(MinNumOfKeyFrames=25))
FROM
FIG. 17A
Title
Wild
Wild
West
intra
OR
Title
Gunsmoke
inter
AND
Creation
Descripton
Creation
Descripton
Creator
Text
Annotation
calvary
intra
OR
Text
Annotation
indian
Text
Annotation
pioneer
role
author
inter
CAND
individual
FamilyName
L'Amor
inter
AND
GivenName
Louis

FIG. 46B

Name	Location	TestOp	InterOp	IntraOp
Level 0 Preferences				
FilteringAndSearchPreferences	null	NA	NA	OR
BrowsingPreferences	null	NA	NA	OR
Level 1 Preferences				
Children of FilteringAndSearchPreferences				
CreationPreferences	/Program/*CreationMetaInformation /*Creation	NA	AND	AND
ClassificationPreferences	/Program/*CreationMetaInformation /*Classification	NA	AND	AND
SourcePreferences	/Program/*UsageMetaInformation	NA	AND	AND
ClassificationPreferences/Country	/Program/*CreationMetaInformation /*Classification/*Country	STR_ISUB	AND	OR
Children of BrowsingPreferences				
SummaryPreferences	/Program/*Summarization	NA	AND	AND
Level 2 Preferences				
Children of CreationPreferences				
Title	/*Title/TitleText	STR_ISUB	AND	OR
CreationDescription	/*CreationDescription	NA	AND	OR
Creator	//*Creator	NA	AND	OR
CreationLocation	/*CreationLocation	NA	AND	OR
CreationDate	/*CreationDate	NA	AND	OR
CreationMaterial	/*CreationMaterial	NA	AND	OR
CreationLocation/Country	/*CreationLocation/Country	STR_ISUB	AND	OR
Children of ClassificationPreferences				
Language	/*Language	STR_ISUB	AND	OR
Genre	/*Genre	STR_ISUB	AND	OR
PackageType	/*PackageType	STR_ISUB	AND	OR

FIG. 47A

Name	Location	TestOp	InterOp	IntraOp
Children of SourcePreferences				
PublicationType	/*Publication/PublicationType	STR_ISUB	AND	NA
Children of SummaryPreferences				
SummaryTypePreference	/*HierarchicalSummary%summaryType	STR_ISUB	AND	OR
SummaryName	/*HierarchicalSummary%name	STR_ISUB	AND	OR
NumOfKeyFrames	/*HierarchicalSummary/*HighlightLevel %numberOfKeyFrames	VAL_EQ	AND	OR
MinNumOfKeyfrmaes	/*HierarchicalSummary/*HighlightLevel %numberOfKeyFrames	VAL_GTE	AND	OR
MaxNumOfKeyframes	/*HierarchicalSummary/*HighlightLevel %numberOfKeyFrames	VAL_LTE	AND	OR
SmmaryDuration	/*HierarchicalSummary/*HighlightLevel /Duration	VAL_EQ	AND	OR
MinSummaryDuration	/*HierarchicalSummary/*HighlightLevel /Duration	VAL_GTE	AND	OR
MaxSummaryDuration	/*HierarchicalSummary/*HighlightLevel /Duration	VAL_LTE	AND	OR
Level 3 Preferences				
Children of CreationDescription				
Who	/Who	STR_ISUB	AND	OR
TextAnnotation	/TextAnnotation	STR_ISUB	AND	OR
Children of Creator				
role	/role	STR_IEQ	CAND	NA
Children of Creator, RealPerson				
Individual	/Individual	NA	AND	OR
QuasiPerson	/QuasiPerson	NA	AND	OR
Children of CreationLocation				

FIG. 47B

PlaceName	/*PlaceName	STR_ISUB	AND	OR
PlaceRole	/PlaceRole	STR_ISUB	AND	NA
Planet	/Planet	STR_ISUB	AND	NA
GPSCoordinates	/GPSCoordinates	STR_ISUB	AND	NA
Region	/Region	STR_ISUB	AND	NA
PostingIdentifier	/PostingIdentifier	STR_ISUB	AND	NA
AdministrativeUnit	/AdministrativeUnit	STR_ISUB	AND	NA
PostalAddress	/PostalAddress	STR_ISUB	AND	NA
InternalCoordinates	/InternalCoordinates	STR_ISUB	AND	NA
Children of CreationMaterial				
device_instrument	/device_instrument	STR_ISUB	AND	NA
device_setting	/device_setting	STR_ISUB	AND	NA
Level 4 Preferences				
Children of Individual, ContactPerson				
FamilyName	/FamilyName	STR_ISUB	CAND	NA
GivenName	/*GivenName	STR_ISUB	CAND	OR
SecondFamilyName	/*SecondFamilyName	STR_ISUB	CAND	OR
Initial	/*Initial	STR_ISUB	CAND	OR
ProfessionalName	/*ProfessionalName	STR_ISUB	CAND	OR
Children of QuasiPerson				
CharacterName	/*CharacterName	STR_ISUB	CAND	OR
RealPerson	/*RealPerson	NA	CAND	OR
Children of Organization				
OrganizationName	/OrganizationName	STR_ISUB	CAND	NA
ContactPerson	/*ContactPerson	NA	CAND	OR
Address	/*Address	NA	CAND	OR
Preference Types				
FilteringAndSearchPreferenceType	/*FilteringAndSearchPreferenceType	NA	NA	OR
BrowsingPreferenceType	/*BrowsingPreferenceType	NA	NA	OR

FIG. 47C

Mapping Table:

name	interOp	intraOp
A	AND	OR
B	AND	OR
C	AND	OR

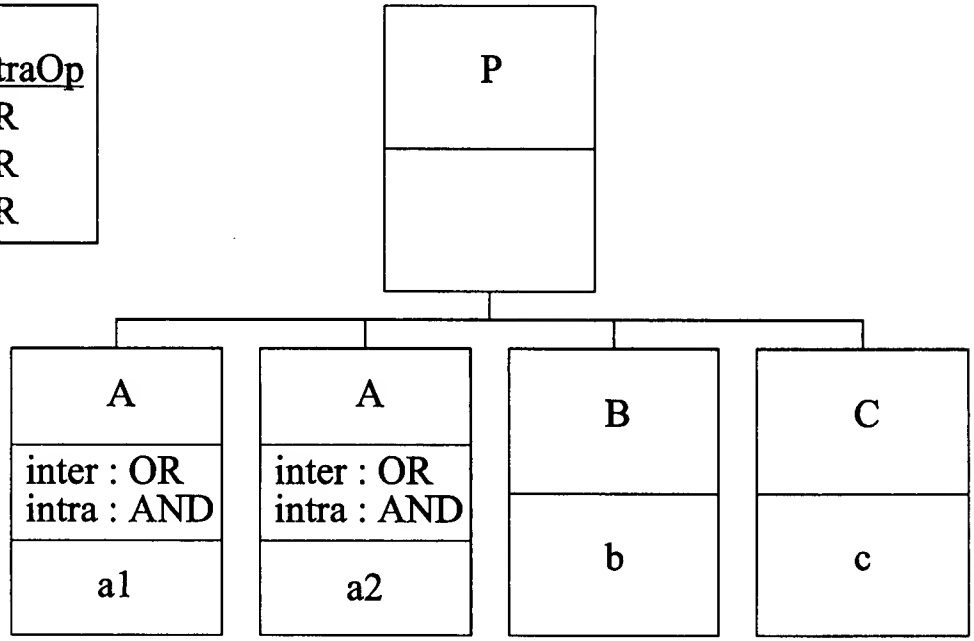


FIG. 48

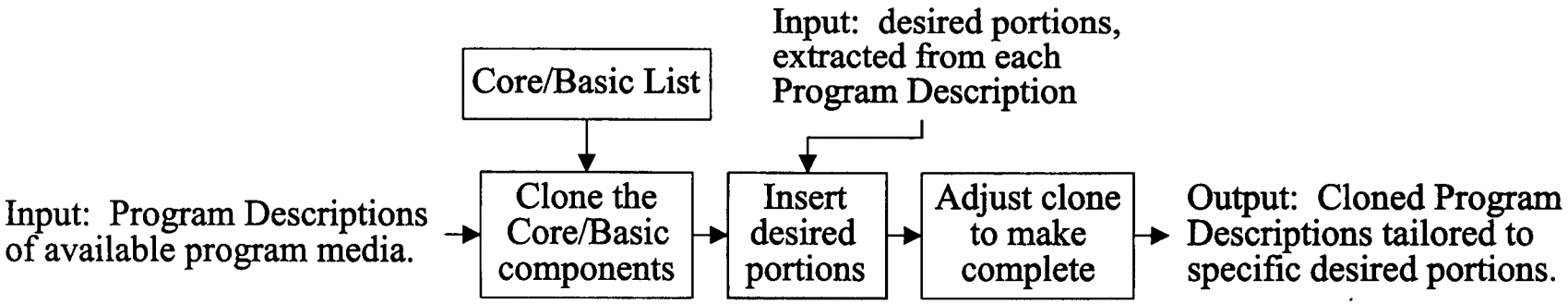


FIG. 49

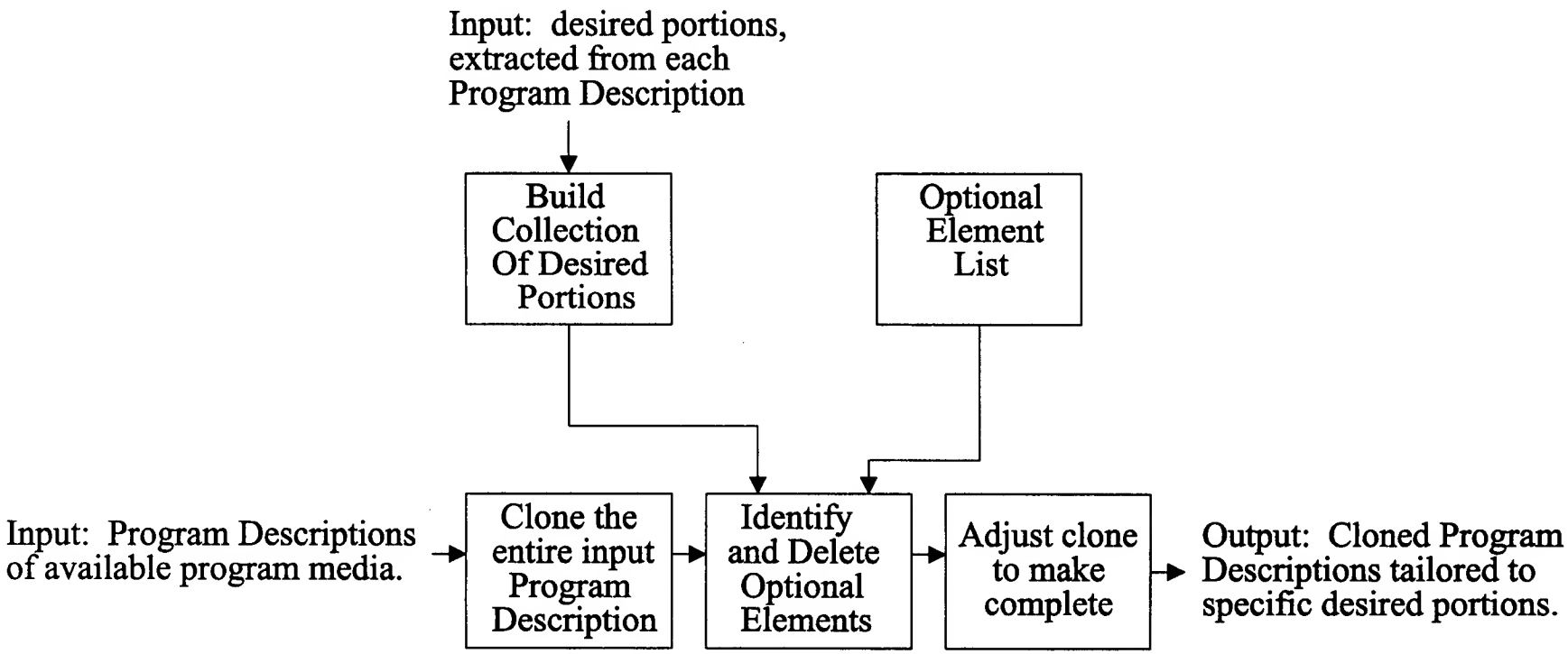

Input: desired portions, extracted from each Program Description
Build Collection Of Desired Portions
Optional Element List
Input: Program Descriptions of available program media.
Clone the entire input Program Description
Identify and Delete Optional Elements
Adjust clone to make complete
Output: Cloned Program Descriptions tailored to specific desired portions.

FIG. 50